2023-1463

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United States Court of Appeals

for the Federal Circuit

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GESTURE TECHNOLOGY PARTNERS, LLC
Appellant,

v.

APPLE INC., LG ELECTRONICS INC., LG ELECTRONICS USA, INC., GOOGLE LLC,
Appellees

Appeal from the United States Patent and Trademark Office in *Inter Partes* Review Nos. IPR2021-00922, IPR2022-00090, and IPR2022-00360 – U.S. Patent No. 8,553,079

**OPENING BRIEF OF PLAINTIFF-APPELLANT
GESTURE TECHNOLOGY PARTNERS, LLC**

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PATENT CLAIMS AT ISSUE

Pursuant to FED. CIR. R. 28(a)(12) the patent claims at issue include claims

1-6, 8-16, 18-26, and 28-30 of U.S. Patent No. 8,553,079.

1.   A computer implemented method comprising:

     providing a light source adapted to direct illumination through a work volume above the light source;

     providing a camera oriented to observe a gesture performed in the work volume, the camera being fixed relative to the light source; and

     determining, using the camera, the gesture performed in the work volume and illuminated by the light source.

2.   The method according to claim 1 wherein the light source includes a light emitting diode.

3.   The method according to claim 1 wherein the light source includes a plurality of light emitting diodes.

4.   The method according to claim 1 wherein detecting a gesture includes analyzing sequential images of the camera.

5.   The method according to claim 1 wherein the detected gesture includes at least one of a pinch gesture, a pointing gesture, and a grip gesture.

6.   The method according to claim 1 further including determining the pointing direction of a finger in the work volume.

8.   The method according to claim 1 further including determining the three-dimensional position of a point on a user.

9.   The method according to claim 1 wherein the camera and the light source are positioned in fixed relation relative to a keypad.

10.   The method according to claim 9 the camera, the light source and the keypad form part of a laptop computer.

11.   A computer apparatus comprising:

a light source adapted to illuminate a human body part within a work volume generally above the light source;

a camera in fixed relation relative to the light source and oriented to observe a gesture performed by the human body part in the work volume; and

a processor adapted to determine the gesture performed in the work volume and illuminated by the light source based on the camera output.

12.   The computer apparatus of claim 11 further including a display and a keyboard, wherein the work volume is above the keyboard and in front of the display.

13.   The computer apparatus of claim 12 wherein the display is pivotable relative to the keyboard.

14.   The computer apparatus of claim 11 wherein the light source includes a light emitting diode.

15.   The computer apparatus of claim 11 wherein the light source includes a plurality of light emitting diodes.

16.   The computer apparatus of claim 12 wherein the display includes a three-dimensional display.

18.   The computer apparatus of claim 11 wherein the determined gesture includes a pinch gesture.

19.   The computer apparatus of claim 11 wherein the determined gesture includes a pointing gesture.

20.   The computer apparatus of claim 11 wherein the determined gesture includes a grip gesture.

21.   A computer implemented method comprising:

      providing a camera oriented to observe a gesture performed in a work volume above the camera;

      providing a light source in fixed relation relative to the camera and adapted to direct illumination through the work volume; and

      detecting, using the camera, a gesture performed by at least one of a user's fingers and a user's hand in the work volume.

22.   The method according to claim 21 wherein the light source includes a light emitting diode.

23.   The method according to claim 21 wherein the light source includes a plurality of light emitting diodes.

24.   The method according to claim 21 wherein detecting a gesture includes analyzing sequential images of the camera.

25.   The method according to claim 21 wherein the detected gesture includes at least one of a pinch gesture, a pointing gesture, and a grip gesture.

26.   The method according to claim 21 further including determining the pointing direction of one of the user's fingers using the first and second cameras.

28.   The method according to claim 21 further including determining the three-dimensional position of a point on at least one of the user's hand and the user's fingers.

29.   The method according to claim 21 further including providing a three-dimensional display viewable by the user.

30.   The method according to claim 21 wherein the camera and the light source are positioned in fixed relation relative to a keypad.

UNITED STATES COURT OF APPEALS
FOR THE FEDERAL CIRCUIT

<u>CERTIFICATE OF INTEREST</u>

Case Number 2023-1463

Short Case Caption Gesture Technology Partners, LLC v. Apple Inc.

Filing Party/Entity Gesture Technology Partners, LLC

Instructions: Complete each section of the form. In answering items 2 and 3, be specific as to which represented entities the answers apply; lack of specificity may result in non-compliance. **Please enter only one item per box; attach additional pages as needed and check the relevant box**. Counsel must immediately file an amended Certificate of Interest if information changes. Fed. Cir. R. 47.4(b).

I certify the following information and any attached sheets are accurate and complete to the best of my knowledge.

Date: 07/17/2023

Signature: /s/ Fred I. Williams

Name: Fred I. Williams

FORM 9. Certificate of Interest   Form 9 (p. 2)
                                                                         July 2020

1. Represented Entities. Fed. Cir. R. 47.4(a)(1).	2. Real Party in Interest. Fed. Cir. R. 47.4(a)(2).	3. Parent Corporations and Stockholders. Fed. Cir. R. 47.4(a)(3).
Provide the full names of all entities represented by undersigned counsel in this case.	Provide the full names of all real parties in interest for the entities. Do not list the real parties if they are the same as the entities. ☐ None/Not Applicable	Provide the full names of all parent corporations for the entities and all publicly held companies that own 10% or more stock in the entities. ☐ None/Not Applicable
Gesture Technology Partners, LLC	N/A	N/A

☐   Additional pages attached

4. Legal Representatives. List all law firms, partners, and associates that (a) appeared for the entities in the originating court or agency or (b) are expected to appear in this court for the entities. Do not include those who have already entered an appearance in this court. Fed. Cir. R. 47.4(a)(4).

☑   None/Not Applicable   ☐   Additional pages attached

5. Related Cases. Provide the case titles and numbers of any case known to be pending in this court or any other court or agency that will directly affect or be directly affected by this court's decision in the pending appeal. Do not include the originating case number(s) for this case. Fed. Cir. R. 47.4(a)(5). See also Fed. Cir. R. 47.5(b).

☐   None/Not Applicable   ☐   Additional pages attached

See Attachment A		

6. Organizational Victims and Bankruptcy Cases. Provide any information required under Fed. R. App. P. 26.1(b) (organizational victims in criminal cases) and 26.1(c) (bankruptcy case debtors and trustees). Fed. Cir. R. 47.4(a)(6).

☑   None/Not Applicable   ☐   Additional pages attached

Attachment A to Certificate of Interest:

5. Related Cases.

- *Gesture Technology Partners, LLC v. Apple Inc.*, 4:22-cv-04806-YGR (U.S. District Court for the Northern District of California)

- *Gesture Technology Partners, LLC v. Motorola Mobility LLC*, 1:22-cv-03535 (U.S. District Court for the Northern District of Illinois)

- *Gesture Technology Partners, LLC v. LG Electronics Inc. et al.*, 2:21-cv-19234-EP-MAH (U.S. District Court for the District of New Jersey)

- *Ex Parte* Reexamination No. 90/014,900 of U.S. Patent No. 8,553,079, before the United States Patent and Trademark Office (reexam ordered December 20, 2021).

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TABLE OF AUTHORITIES

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I.   STATEMENT OF RELATED CASES

Pursuant to Federal Circuit Rule 47.5, Appellant Gesture Technology Partners, LLC states that no other appeal in or from the same civil action in the lower court was previously before this or any other appellate court.

Cases pending in this or any other court which will directly affect or be directly affected by this Court's decision in the pending appeal are listed below.

- *Gesture Technology Partners, LLC v. Apple Inc.,* Case No. 4:22-cv-04806 (N.D. Cal.)

- *Gesture Technology Partners, LLC v. LG Electronics, Inc.,* Case No. 2:21-cv-19234 (D.N.J.)

- *Gesture Technology Partners, LLC v. Motorola Mobility LLC,* Case No. 1:22-cv-03535 (N.D. Ill.)

- *Ex Parte Reexamination* No. 90/014,900 of U.S. Patent No. 8,553,079, before the USPTO (reexam ordered December 20, 2021; notice of appeal to the Patent Trial and Appeal Board, under 35 U.S.C. § 134, filed on August 29, 2022).

II.   JURISDICTIONAL STATEMENT

Appellant Gesture Technology Partners, LLC, appeals from the Patent Trial and Appeal Board's final written decision in the *inter partes* review proceeding of U.S. Patent No. 8,553,079 (the "'079 Patent"). The Board had jurisdiction pursuant to 35 U.S.C. § 314. The Board entered the final written decision on November 28, 2022 (the "FWD"). Appx0001-0028. Appellant Gesture Technology Partners, LLC, filed a timely notice of appeal on January 27, 2023. Appx0405-0409. This Court has jurisdiction pursuant to 28 U.S.C. § 1295(a)(4)(A) and 35 U.S.C. § 141(c).

III.   STATEMENT OF THE ISSUES

1.   Whether the Board improperly construed the timing of the light source during the performance of the gesture in independent claims 1, 11, and 21 of the '079 Patent.

2.   Whether the Board committed reversible error when it found that *Numazaki* and the knowledge of a person having ordinary skill in the art ("PHOSITA") rendered independent claims 1-2, 4-6, 8-14, 16, 18-19, and 21-22, 24-26, and 28-30 of the '079 Patent unpatentable.

3.   Whether the Board improperly construed the operation of the light source claims 3, 15, and 23 of the '079 Patent.

4.   Whether the Board committed reversible error when it found claims 3, 15, and 23 of the '079 Patent unpatentable over *Numazaki* and *Numazaki '863*.

5.   Whether the USPTO has jurisdiction over expired patents.

IV.   STATEMENT OF THE CASE AND FACTS

A.   Procedural Background

This appeal involves the '079 Patent, which is owned by Appellant Gesture Technology Partners, LLC ("Patent Owner"). Appx0029. The '079 Patent was filed on December 14, 2012, as U.S. Patent Application No. 13/714,748. *Id.* The '079 Patent issued on October 8, 2013. *Id.* Appellee Apple, Inc. ("Petitioner") filed a petition for *inter partes* review of claims 1-30 of the '079 Patent on November 29, 2021. Appx0045-0126 (the "Petition"). The Patent Trial and Appeal Board (the "Board") authorized *inter partes* review of the challenged claims on March 17, 2022. Appx0181-0200. Patent Owner filed a response to the Petition on February 22, 2022. Appx0152-0179. Petitioner filed a reply on May 16, 2022 (Appx0271-0298),

and Patent Owner filed a sur-reply on June 27, 2022 (Appx0299-0314).   On

September 13, 2022, the Board heard oral argument regarding the Petition and the

Parties' briefing. Appx0315-0318. On November 28, 2022, the Board issued a Final

Written Decision ("FWD"). Appx0001-0028. The Board concluded that Petitioner

"has proven, by a preponderance of the evidence, that some of the challenged claims

are unpatentable, as summarized in the following table:"

Claims	35 U.S.C. §	Reference(s) /Basis	Claims Shown Unpatentable	Claims Not Shown Unpatentable
1, 2, 4–14, 17, 19, 21, 22, 24–28, 30	103(a)	Numazaki, Knowledge of a PHOSITA	1, 2, 4–6, 8– 14, 19, 21, 22, 24–26, 28, 30	7, 17, 27
3, 15, 23	103(a)	Numazaki, Numazaki '863	3, 15, 23	
16, 29	103(a)	Numazaki, DeLuca	16, 29	
18	103(a)	Numazaki, DeLeeuw	18	
20	103(a)	Numazaki, Maruno	20	
Overall Outcome			1–6, 8–16, 18– 26, 28–30	7, 17, 27

Appx0027.

B.   The '079 Patent

The '079 Patent is titled "More Useful Man Machine Interfaces and

Applications." Appx0029. The '079 Patent is directed towards methods and

apparatuses "for determining a gesture illuminated by a light source." Appx0029,

Abstract. These methods and apparatuses "utilize the light source to provide illumination through a work volume above the light source. A camera is positioned to observe . . . the gesture performed in the work volume." *Id*.

In some embodiments, the '079 Patent describes a computer device with one or more "cameras to look at points on, typically, the hand or the finger, or objects held in the hand of the user, which are used to input data to the computer." Appx0038 (1:66-2:2). Figure 2, which is reproduced below, depicts some embodiments in which a computer device (e.g., laptop) includes the functionality of the invention:

FIG. 2

Appx0032 (FIG. 2).

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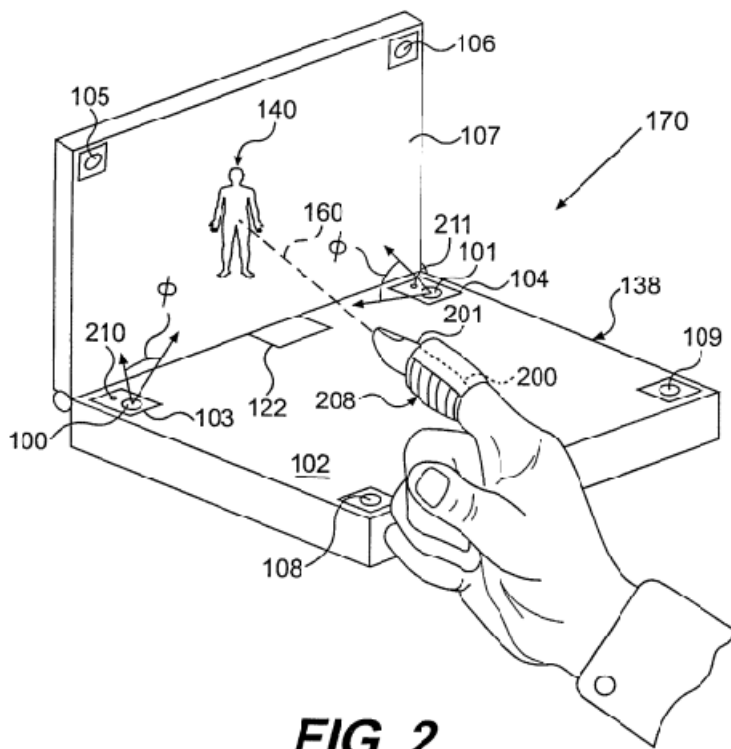
In some embodiments, the '079 Patent describes that the computer device can "determine the pointing direction vector 160 of the user's finger (for example pointing at an object displayed on screen 107), or the position and orientation of an object held by the user." Appx0038 (2:54-60). The '079 Patent also discloses that "finger position data can be used to determine gestures such as pinch or grip, and other examples of relative juxtaposition of objects with respect to each other." *Id.* The patent also discloses that "[f]inger gestures comprising a sequence of finger movements can also be detected by analyzing sequential images sets such as the motion of the finger." *Id.* (3:48-50). A target (e.g., retro-reflective material) may be placed on an object (e.g., user's finger) to augment the contrast of the object. *See Id.* (3:63-4:14).

C.   The Board's Final Written Decision for the '079 Patent

The Petition asserted five grounds of unpatentability based on five alleged prior-art references:

Proposed Ground of Unpatentability	Exhibits
Ground 1: Claims 1, 2, 4-14, 17, 19, 21-22, 24-28, and 30 are obvious under pre-AIA 35 U.S.C. § 103 over U.S. Patent No. 6,144,366 ("*Numazaki*") in view of the knowledge of a PHOSITA	Ex. 1004
Ground 2: Claims 3, 15, and 23 are obvious under pre-AIA 35 USC § 103 over *Numazaki* in view of U.S. Patent No. 5,900,863 ("*Numazaki '863*")	Ex. 1004, Ex. 1005
Ground 3: Claims 16 and 29 are obvious under pre-AIA 35 U.S.C § 103 over *Numazaki* in view of U.S. Patent No. 6,064,354 ("*DeLuca*")	Ex. 1004, Ex. 1006
Ground 4: Claim 18 is obvious under pre-AIA 35 U.S.C § 103 over *Numazaki* in view of U.S. Patent No. 6,008,018 ("*DeLeeuw*")	Ex. 1004, Ex. 1007
Ground 5: Claim 20 is obvious under pre-AIA 35 USC § 103 over *Numazaki* in view of U.S. Patent No. 6,191,773 ("*Maruno*")	Ex. 1004, Ex. 1008

Appx0051 (Petition p. 5).

For each of the five grounds, Petitioner alleged that the challenged claims of the '079 Patent are rendered obvious under 35 U.S.C. § 103(e) by U.S. Patent 6,144,366 to Numazaki et al. (filed October 17, 1997; issued November 7, 2000) ("*Numazaki*") in view of the knowledge of a person having ordinary skill in the art ("PHOSITA") or one of four prior art references. *Id.* The four prior art references in addition to *Numazaki* are U.S. Patent 5,900,863, issued May 4, 1999 ("*Numazaki '863*"); U.S. Patent 6,064,354, issued May 16, 2000 ("*DeLuca*"); U.S. Patent 6,088,018, issued July 11, 2000 ("*DeLeeuw*"); and U.S. Patent 6,191,773, issued Feb. 20, 2001 ("*Maruno*"). Appx0005.

1.   The Board found that the term "wherein the light source includes a plurality of light emitting diodes" should be given its plain and ordinary meaning.

Dependent claims 3, 15, and 23 recited "wherein the light source includes a plurality of light emitting diodes." The term "the light source" refers back to the "light source" recited in each respective independent claim. For example, independent claim 1 requires the step of "providing a light source adapted to direct illumination through a work volume above the light source." Appx0044 (13:3-4). Patent Owner proposed that the term "wherein the light source includes a plurality of light emitting diodes," in claims 3, 15, and 23 means "the light source illuminates the gesture by having two or more (i.e., a plurality) LEDs of the light source emit light at the same time." Appx0007; Appx00226-00228. Patent Owner argued that this construction is consistent with the specification of the '079 Patent that describes the purpose of the light source as increasing the amount of light incident to the object (e.g., finger) performing the gesture." Appx0039 (3:1-3).

Patent Owner argued that a PHOSITA would interpret claim 1 to require the light source to illuminate the gesture at least while the camera is capturing one or more images of the gesture. Appx1384-1385 (¶ 52). Any image of the gesture is captured by the camera while the gesture is illuminated by the light source. Because the component that "determin[es] . . . the gesture performed in the work volume" expressly uses the camera to do so, that component must have access to the image(s)

captured by the "camera . . . observ[ing] the gesture performed in the work volume." *Id.* The Board rejected this argument, reasoning that Patent Owner did not identify anywhere in the specification where "light source" or "plurality of light emitting diodes" are defined as "the light source illuminates the gesture by having two or more (i.e., a plurality) LEDs of the light source emit light at the same time." Appx0009.

Ultimately, the Board found that "the light source includes a plurality of light emitting diodes" should be given its plain and ordinary meaning, which according to the Board does not require two or more (i.e., a plurality) LEDs of the light source emit light at the same time. *See id.*

2. The Board Found Claims 1, 11, and 21 Unpatentable Over *Numazaki* and the Knowledge of a PHOSITA.

Claim 1 requires "providing a camera oriented to observe a gesture performed in the work volume, the camera being fixed relative to the light source." Appx0044 (13:5–7). Petitioner relied on *Numazaki's* portable computer with an information input generation device of Figure 74 with its photo-detection sensor unit (702) for the "providing a camera" method step of claim 1. Appx0047-0048. *Numazaki* discloses that the "eighth embodiment [including the portable computer of Figure 74] is directed to a system configuration incorporating the information input generation apparatus of the present invention

as described in the above embodiments [1-7]." Appx0746 (50:21-24). Petitioner relied on that disclosure in an attempt to link *Numazaki's* "light and camera arrangement" of Figure 2 to the photo-detection sensor unit of Figure 74. Appx0059-0060. The Board agreed with that argument. Appx0014.
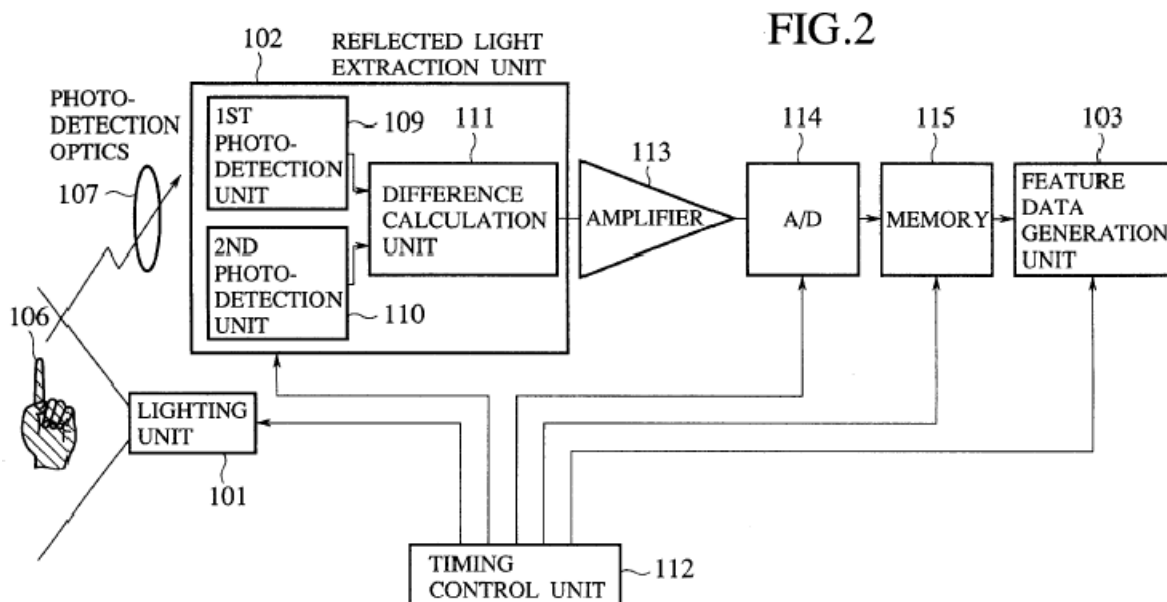
FIG.2

Appx00622 (FIG. 2).

Patent Owner argued, with support from its expert declarant, that *Numazaki* contains no disclosure stating that the "photo-detection sensor unit" is a camera and a PHOSITA would not find that any of embodiments 1–7 disclose the "photo-detection sensor unit" in Fig. 74 as being or including a camera. Appx0229; *see also* Appx1381-1382 (¶ 48).

FIG.74
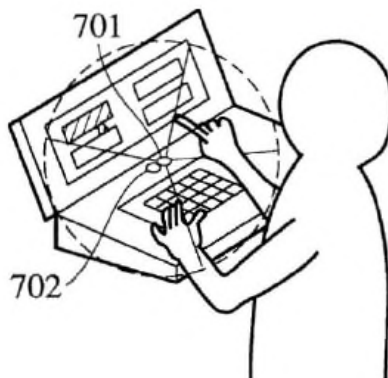
Appx0693 (FIG. 74).

The Board found that the photo-detection section of the eighth embodiment in *Numazaki*, including the "photo-detection sensor unit" of Figure 74, incorporates the disclosure of the photo-detection section of the prior embodiments, including Figure 2. Appx0015. The Board determined that one of ordinary skill in the art would have understood *Numazaki* to teach that the "photo-detection sensor unit" in Figure 74 is or at least includes a camera, just as Numazaki's reflected light extraction unit with its two photo detection units in Figure 2 teach a camera. Appx0016.

Petitioner relied on *Numazaki* to teach "determining, using the camera, the gesture performed in the work volume and illuminated by the light source." Pet. 12. According to Petitioner, *Numazaki's* lighting and photo-detection sensor units are used to determine a hand gesture in the area above the laptop.

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Appx0058-0059 (citing Appx0746, 50:30–43).   Petitioner further relied on *Numazaki's* teaching that "light and camera arrangement" of Figure 2 "is incorporated into the eighth embodiment" for more details about the photo-detection sensor unit. Appx0059-0060; *see also* Appx0059.

The Board concluded that claim 1 does not require that the gesture remain permanently illuminated. The Board found that *Numazaki* teaches a second photo-detection unit that captures the gesture while lighting unit 101 is not active is not excluded by the language of the claim. According to the FWD, *Numazaki* compares both images in determining the gesture is also not excluded by the claim and Claim 1 merely requires that the determining be made "using the camera," that "the gesture [be] performed in the work volume" and that the gesture be "illuminated by the light source" at some point in time. Appx0018.

The FWD states that claims 11 and 21 are "very similar" to claim 1 and, therefore, claims 11 and 21 are also unpatentable for the same reasons as claim 1. Appx0019.

3.   The Board Found Claims 3, 15, and 23 Unpatentable Over *Numazaki* and *Numazaki '863*.

Patent Owner argued that *Numazaki* in combination with *Numazaki '863* fails to render obvious claims 3, 15, and 23. Appx0175-0177. The Board rejected Patent Owner's argument that the term "wherein the light source includes a plurality of

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light emitting diodes" in claims 3, 15, and 23 should be construed to mean "the light source illuminates the gesture by having two or more (i.e., a plurality) LEDs of the light source emit light at the same time." Appx0007; Appx0226-0228. The Board reasoned that under the plain and ordinary meaning of the term, claims 3, 15, and 23 are unpatentable. Appx0023-0024.

4. The Board Found Claims 16, 18, 20 and 29 Unpatentable Over *Numazaki* in Combination with *DeLuca*, *DeLeeuw*, or *Maruno*.

Patent Owner argued that *Numazaki* does not teach or suggest one or more limitations of claim 11 and 21. Appx0242-0243. Patent Owner argued that the combination of *Numazaki* with *DeLuca*, *DeLeeuw*, or *Maruno* did not remedy the deficiencies. *Id*.

Specifically, Patent Owner showed that dependent claims 16 and 29 depend from and add limitations to claims 11 and 21, respectively. Appx0242. Therefore, the combination of *Numazaki* and *DeLuca* fails to render dependent claims 16 and 29 unpatentable. *Id*. Patent Owner also showed that dependent claim 18 depends from and adds limitations to claim 11. Appx0242-0243. Therefore, the combination of *Numazaki* and *DeLeeuw* fails to render dependent claim 18 unpatentable. *Id*. Finally, Patent Owner showed that dependent claim 20 depends from and adds limitations to claim 11. Appx0243. Therefore, the combination of *Numazaki* and *Maruno* fails to render dependent claim 20 unpatentable. *Id*.

The Board found that "Patent Owner does not separately address these grounds." Appx0024. But Patent Owner addressed each of these grounds by arguing that *Numazaki* in combination with *DeLuca*, *DeLeeuw*, or *Maruno* did not render obvious claims 16, 18, 20, and 29. Appx0242-0243.

V.   SUMMARY OF THE ARGUMENT

The Board improperly construed the timing of the light source during the performance of the gesture in independent claims 1, 11, and 21 of the '079 Patent. The Board committed reversible error when it found claims 1, 11, and 21 of the '079 Patent unpatentable over *Numazaki* and the knowledge of a PHOSITA. Because the FWD's findings as to independent claims 1, 11, and 21 are not supported by substantial evidence, the same conclusion applies to dependent claims 2, 4-6, 8-10, 12-14, 16, 18-19, 22, 24-26, and 28-30 of the '079 Patent. Therefore, the Board's FWD should be vacated and remanded with the proper construction of the timing of the light source.

Next, the Board improperly construed the operation of the light source claims 3, 15, and 23 of the '079 Patent. The Board committed reversible error when it found claims 3, 15, and 23 of the '079 Patent unpatentable over *Numazaki* and *Numazaki '863*. Therefore, the Board's FWD should be vacated and remanded with the proper construction of the operation of the light source.

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The '079 Patent expired in November 2019, long before the IPR Petition was filed on April 18, 2021. When a patent expires, the public franchise ceases to exist and the franchisee (e.g., the patent owner) no longer has the right to exclude others. At most, the franchisee may be entitled to collect damages from the public franchise that formerly existed through an infringement action in district court. But because the public franchise no longer exists after patent expiration, the Patent Office has nothing in its authority to cancel or amend. Accordingly, upon expiration of the '079 Patent, the Board ceased to have jurisdiction over the '079 Patent, so the FWD should be vacated.

VI.   STANDARD OF REVIEW

"Claim construction is ultimately a question of law, decided *de novo* on review, as are the intrinsic-evidence aspects of a claim-construction analysis." *Intel Corp. v. Qualcomm Inc.*, 21 F.4th 801, 808 (Fed. Cir. 2021). A final written decision in an *inter partes* review may be remanded to the Board to consider the patentability grounds under the proper construction. *Virnetx Inc. v. Mangrove Partners Master Fund, Ltd.*, 778 F. App'x 897, 910 (Fed. Cir. 2019).

"Obviousness is a mixed question of law and fact, and we review the Board's ultimate obviousness determination *de novo* and underlying fact-findings for substantial evidence." *Mylan Pharms. Inc. v. Merck Sharp & Dohme Corp.*, 50 F.4th 147, 152 (Fed. Cir. 2022) (cleaned up). "Substantial evidence is something less than

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the weight of the evidence but more than a mere scintilla of evidence . . . and means such relevant evidence as a reasonable mind might accept as adequate to support a conclusion." *In re Suitco Surface, Inc.*, 603 F.3d 1255, 1259 (Fed. Cir. 2010) (internal citations and quotations omitted). A finding is supported by substantial evidence if "a reasonable mind might accept the evidence as adequate to support" the finding. *In re Jolley*, 308 F.3d 1317, 1320 (Fed. Cir. 2002) (quoting *Consol. Edison Co. v. NLRB*, 305 U.S. 197, 229 (1938)). "In reviewing the record for substantial evidence, this court takes into account evidence that both justifies and detracts from the factual determinations." *In re Glatt Air Techniques, Inc.*, 630 F.3d 1026, 1029 (Fed. Cir. 2011). In reaching its decisions, the Board must "make the necessary findings and have an adequate 'evidentiary basis for its findings.'" *In re Nuvasive*, 842 F.3d 1376, 1382 (Fed. Cir. 2016) (quoting *In re Lee*, 277 F.3d 1338, 1344 (Fed. Cir. 2002)). If the Board lacks substantial evidence for its conclusions on obviousness, the final written decision should be vacated. *See GE v. Raytheon Techs. Corp.*, 983 F.3d 1334, 1336 (Fed. Cir. 2020).

VII. ARGUMENT

A.   The Board Improperly Construed the Claim Term "Light Source."

The words of a claim "are generally given their ordinary and customary meaning." *Phillips v. AWH Corp.*, 415 F.3d 1303, 1312 (Fed. Cir. 2005) (en banc). The "ordinary meaning" of a claim term "is its meaning to the ordinary artisan after

reading the <u>entire patent</u>." *Id.* at 1321 (emphasis added). The "claims themselves provide substantial guidance as to the meaning of particular claim terms," and thus the "context of the surrounding words of the claim also must be considered in determining the ordinary and customary meaning of those terms." *Id*. at 1314 (cleaned up).

> **1.   The Board Improperly Construed the Timing of the Light Source During the Performance of the Gesture in Independent Claims 1, 11, and 21.**

Independent claim 1 recites, in part, "a light source adapted to direct illumination through a work volume" so as to determine a "gesture performed in the work volume and illuminated by the light source" using "a camera oriented to observe [the] gesture." Appx0044 (13:2-9). According to the Board, independent claim 1 "does not require that the gesture remain permanently illuminated." Appx0018. Also, according to the Board, "[t]he claim merely requires that . . . the gesture be 'illuminated by the light source' at some point in time." *Id*. But the plain language of the claim says otherwise—the determination is made on a gesture that is illuminated by the light source, not on non-illuminated gestures. That is why a PHOSITA would interpret claim 1 to require that the light source illuminate the gesture at least while the camera captures images of the gesture. There should be no dispute that the claimed camera captures images—that is what cameras do. It is these captured images that are used for "determining . . . the gesture."

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This interpretation is consistent with the specification, which describes the light source as illuminating the object (e.g., finger) performing the gesture to make it easier for a camera to observe and recognize the object. *See, e.g.,* Appx0039 (3:1-8) ("Light from below, such as provided by [the light source] can be used to illuminate the finger that typically looks bright under such illumination. It is also noted that the illumination is directed or concentrated in an area where the finger is typically located such as in work volume 170. If the light is of sufficient spectral content, the natural flesh tone of the finger can be observed—and recognized by use of the color TV cameras. *See* Appx0029, Abstract ("method for determining <u>a gesture illuminated by a light source</u> utilizes the light source to provide illumination through a work volume above the light source.") (emphasis added). Unsurprisingly, there is no disclosure in the specification of the light source turning off or strobing while the gesture is being performed as this would frustrate operation of the "camera oriented to observe [the] gesture performed in the work volume." Further, gestures can only be captured with multiple images because they entail motion. *See, e.g.,* Appx0044 (13:14-15) ("wherein detecting a gesture includes analyzing <u>sequential images of the camera</u>") (emphasis added); Appx0044 (13:16-18) ("wherein the detected gesture includes at least one of a <u>pinch gesture</u>, a pointing gesture, and a grip gesture") (emphasis added); Appx0039 (3:48-51) ("Finger gestures comprising a sequence of finger movements can also be detected by analyzing <u>sequential image</u>

sets such as the motion of the finger, or one finger with respect to another such as in pinching something can be determined.") (emphasis added). It would be illogical to illuminate the gesture for some of the images but not others. That is why a PHOSITA would interpret claim 1 to require that the light source illuminate the gesture at least while the camera captures images of the gesture. *See* Appx1384-1385 (¶ 52).

In view of the foregoing, the Board's improper construction of claim 1 should be vacated. Independent claims 11 and 21 recite similar limitations involving a light source. *See* Appx0018-Appx0019 ("Independent claim 11 is directed to a computer apparatus and is very similar to method claim 1 . . . Independent claim 21 is directed to a computer implemented method and is very similar to method claim 1"). Moreover, independent claim 11 expressly recites "the camera output" (i.e., images of the gesture captured by the camera while the gesture is illuminated by the light source). Accordingly, the Board's improper construction of claims 11 and 21 should be vacated for the same reasons.

B.   The Board Erred in Determining That *Numazaki* Renders Obvious Independent Claims 1, 11, and 21.

Claim element 1[b] recites "providing a camera oriented to observe a gesture performed in the work volume, the camera being fixed relative to the light source; and determining, using the camera, the gesture performed in the work volume and illuminated by the light source." The FWD's finding that *Numazaki* teaches claim

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element 1[b] should be vacated because it is not supported by substantial evidence. *See* Appx0012-0018.

    1.   ***Numazaki* Fails to Teach Determining a "Gesture Performed In The Work Volume And Illuminated By The Light Source."**

Claim element 1[b] recites, in part, "determining, using the camera, the gesture performed in the work volume and illuminated by the light source." Appx0044, 13:2-9. As discussed above, under a proper claim construction, the gesture is illuminated by the light source at least while the camera is capturing images of the gesture. *See supra* VII.A.1.

The Board found that *Numazaki's* "lighting unit" and *Numazaki's* "hand gesture" are the claimed "light source" and claimed "gesture," respectively. Appx0012; Appx0018. But *Numazaki* expressly teaches that "[e]ach of the first photo-detection unit 109 and the second photo-detection unit 110 detects the optical image [of the hand gesture] formed on the photo-detection plane . . . the lighting unit 101 emits the light when the first photo-detection unit 109 is in a photo-detecting state, whereas the lighting unit 101 <u>does not emit the light</u> when the second photo-detection unit 110 is in a photo-detecting state." Appx0727 (11:20-33) (emphasis added). In other words, *Numazaki's* "lighting unit" (the Board-identified "light source") is <u>not</u> illuminating *Numazaki's* "hand gesture" (the Board-identified "gesture") the entire time that *Numazaki's* "hand gesture" is being performed or

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detected. To the contrary, the "hand gesture" is not illuminated for at least half of the motion associated with the gesture. That contradicts what is required by claim element 1[b].

In view of the foregoing, the FWD's finding that *Numazaki* teaches claim element 1[b] is not supported by substantial evidence. Accordingly, the Board's determination that *Numazaki* renders claim 1 obvious should be vacated.

Independent claims 11 and 21 recite limitations that are similar to claim element 1[b]. *See* Appx0018-Appx0019 ("Independent claim 11 is directed to a computer apparatus and is very similar to method claim 1 . . . Independent claim 21 is directed to a computer implemented method and is very similar to method claim 1 . . . As such, the Petition relies on essentially the same teachings of Numazaki discussed above with respect to claim 1 for the features of claims 11 and 21, which we agree . . ."). Thus, the FWD's findings that *Numazaki* teaches those limitations of claims 11 and 21 are not supported by substantial evidence. Accordingly, the Board's determinations that *Numazaki* renders claims 11 and 21 obvious should be vacated.

2.   *Numazaki* Fails to Teach "Determining, Using The Camera, The Gesture."

Claim element 1[b] recites, in part, "a camera oriented to observe a gesture performed in the work volume" and "determining, using the camera, the gesture performed in the work volume." Appx0044 (13:2-9) (emphasis added). There

should be no dispute that a "camera" must capture an image. Because the component that "determin[es] . . . the gesture performed in the work volume" expressly uses the camera to do so, that component must have access to the image(s) captured by the "camera . . . observ[ing] the gesture performed in the work volume."

The Board found that *Numazaki's* "feature data generation unit" is the component that performs the claimed "determining" step, and that *Numazaki's* "photo-detection sensor unit" is the claimed "camera." *See* Appx0016-0018. Even if those findings were supported by substantial evidence—they are not—*Numazaki* still fails to teach or suggest that *Numazaki's* "feature data generation unit" has access to the image allegedly obtained by *Numazaki's* "photo-detection sensor unit" (the Board-identified "camera"), as claim element 1[b] requires. For example, there is no figure in *Numazaki* showing the output of *Numazaki's* "photo-detection sensor unit" (the Board-identified "camera") being fed to *Numazaki's* "feature data generation unit." Figures 74 and 75 of *Numazaki* show photo-detection sensor units 702 and 704, respectively. Appx0693; *see also* Appx0746-0747 (50:25-35, 51:6-15). But neither figure shows the output of its photo-detection sensor unit. Similarly, there is no disclosure in *Numazaki* regarding the relationship, if any, between *Numazaki's* "feature data generation unit" and *Numazaki's* "photo-detection sensor unit." *See id.* Based on this fact alone, *Numazaki* fails to teach or

suggest claim element 1[b], so the FWD's finding cannot be supported by substantial evidence.

Although the Board does not expressly concede that this teaching is missing from *Numazaki*, the Board does attempt to equate *Numazaki's* "photo-detection sensor unit" to other components in *Numazaki* that have a relationship with *Numazaki*'s "feature data generation unit." Appx0013. *Numazaki's* "photo-detection sensor unit" is mentioned for the first time in *Numazaki's* eighth embodiment. Appx0746 (50:21-24). *Numazaki* discloses that "[t]his eighth embodiment is directed to a system configuration <u>incorporating</u> the information input generation apparatus of the present invention as described in the above embodiments [1-7]." *Id.* (emphasis added). But it is unclear whether *Numazaki's* "photo-detection sensor unit" is a component unique to *Numazaki's* eighth embodiment, or whether *Numazaki's* "photo-detection sensor unit" is a component of an incorporated "information input generation apparatus" from one of embodiments 1-7. *Numazaki* consistently uses the term "lighting unit" across all of embodiments 1-8. *See*, *e.g.*, Appx0726 (10:29-32) and Appx0747 (52:12-14). Accordingly, there is little doubt that the "lighting unit" in *Numazaki's* eighth embodiment corresponds to the "lighting unit" in, for example, *Numazaki's* first embodiment. But because *Numazaki's* embodiments 1-7 do not mention the "photo-detector sensor unit," *Numazaki's* "photo-detection sensor unit" is unique to

Numazaki's eighth embodiment. Because *Numazaki* uses this new term for the first time in embodiment 8, it is erroneous for the Board to equate *Numazaki's* "photo-detection sensor unit" to anything in *Numazaki's* embodiments 1-7.

Even if *Numazaki's* "photo-detection sensor unit" could be equated to one or more components from *Numazaki's* embodiments 1-7 (i.e., if *Numazaki's* "photo-detection sensor unit" were not unique to *Numazaki's* eight embodiment), there are still evidentiary shortcomings undermining the Board's finding. *Numazaki's* embodiments 1-7 teach multiple "photo-detection units" and a "reflected light extraction unit." Appx0726-0746. In its discussion of the "photo-detection sensor unit," the Board references both "photo-detection units" and the "reflected light extraction unit." Appx0014; Appx0016. This is not surprising because it is simply not apparent whether and which component(s) in *Numazaki's* embodiments 1-7 could equate to *Numazaki's* "photo-detection sensor unit." Those ambiguities in *Numazaki* make it difficult to determine "the scope and content of the prior art" and ascertain "differences between the prior art and the claims," as required for a proper obviousness analysis. *KSR Int'l Co. v. Teleflex Inc.*, 550 U.S. 398, 406 (2007) (citing *Graham v. John Deere Co.*, 383 U.S. 1, 17 (1966)).

To the extent the Board equated *Numazaki's* "photo-detection unit 109" to *Numazaki's* "photo-detection sensor unit" (the Board-identified "camera"), that does not satisfy the requirements of claim element 1[b]. *Numazaki* discloses the "the first

photo-detection unit 109 . . . detects the optical image formed on the photo-detection plane." Appx0727 (11:20-22). But the image "formed on the photo-detection plane" is never made available to *Numazaki's* "feature data generation unit" (the Board-identified component that performs the claimed "determining" step) for any purpose. Rather, multiple images that are formed on the "photo-detection plane" are simply subtracted from each other to obtain another image that *Numazaki* refers to as the "reflected light image." Appx0727 (11:9-62). The "reflected light image" is not obtained by "photo-detection unit 109," but rather is determined through the subtraction of the two images (captured at different times) on the same "photo-detection plane." *Id*. *Numazaki* does not analyze an image on the "photo-detection plane" to "determin[e] . . . the gesture performed in the work volume," as claim element 1[b] requires. The only purpose of the subtraction process is to form a new image. *See* Appx0727 (11:20-61). Accordingly, *Numazaki* fails to teach or suggest claim element 1[b], so the FWD is not supported by substantial evidence.

To the extent the Board equated *Numazaki's* "reflected light extraction unit" to *Numazaki's* "photo-detection sensor unit" (the Board-identified "camera"), that also does not teach or suggest claim element 1[b]. Patent Owner asserts that the "reflected light extraction unit" cannot be the claimed "camera" for at least two reasons.

First, it is undisputed that "the words of a claim are generally given their ordinary and customary meaning." *Phillips v. AWH Corp.*, 415 F.3d 1303, 1312 (Fed. Cir. 2005) (en banc). But there is no evidence in the record that the "ordinary and customary" meaning of "camera" includes a device that has a "difference calculation unit" that operates like *Numazaki's* "reflected light extraction unit." Appx0727 (11:20-61). A device with a "difference calculation unit" and that operates like *Numazaki's* "reflected light extraction unit" is not an ordinary camera. Accordingly, *Numazaki's* "reflected light extraction unit" is not and cannot be the claimed "camera." Thus, it was erroneous for the Board to equate *Numazaki's* "photo-detection sensor unit" (the Board-identified "camera") to *Numazaki's* "reflected light extraction unit."

Second, *Numazaki's* "reflected light extraction unit" necessarily captures an image of the gesture while *Numazaki's* "lighting unit" (the Board-identified "light source") is turned off (i.e., not emitting light). *See* Appx0727 (11:27-34) ("the lighting unit 101 emits the light when the first photo-detection unit 109 is in a photo-detecting state, whereas the <u>lighting unit 101 does not emit the light</u> when the second photo-detection unit 110 is in a photo-detecting state.") (emphasis added). But under the plain meaning of "determining, using the camera, the gesture performed in the work volume and illuminated by the light source" discussed above (i.e., light source illuminates the gesture at least while the camera is capturing one or more images of

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the gesture) (*see supra* VII.A.1), it would not be possible for *Numazaki's* "reflected light extraction unit" (the Board-identified "camera") to operate as intended.

In view of the foregoing, the FWD's finding that *Numazaki* teaches claim element 1[b] is not supported by substantial evidence. Accordingly, the Board's determination that *Numazaki* renders claim 1 obvious should be vacated.

Independent claims 11 and 21 recite limitations that are similar to claim element 1[b]. *See* Appx0018-Appx0019 ("Independent claim 11 is directed to a computer apparatus and is very similar to method claim 1 . . . Independent claim 21 is directed to a computer implemented method and is very similar to method claim 1 . . . As such, the Petition relies on essentially the same teachings of Numazaki discussed above with respect to claim 1 for the features of claims 11 and 21, which we agree . . ."). Moreover, independent claim 11 expressly recites "camera output" (i.e., images of the gesture captured by the camera while the gesture is illuminated by the light source) and "a processor," which Petitioner also identified as *Numazaki's* "feature data generation unit." Appx0075-0076. Thus, the FWD's finding that *Numazaki* teaches those limitations of claims 11 and 21 is not supported by substantial evidence for the same reasons as claim 1. Accordingly, the Board's determinations that *Numazaki* renders claims 11 and 21 obvious should be vacated.

3. Claims 2, 4-6, 8-10, 12-14, 16, 18-20, 22, 24-26, and 28-30 Are Patentable.

Claims 2, 4-6, and 8-10 depend from and add limitations to claim 1 of the '079 Patent. Claims 12-14 and 19 depend from and add limitations to claim 11 of the '079 Patent. Claims 22, 24-26, 28, and 30 depend from and add limitations to claim 21 of the '079 Patent. Each of claims 16, 18, 20, and 29 depends from and add limitations to claim 11 or claim 21 of the '079 Patent.

The FWD's finding that claims 1, 11, and 21 are unpatentable over *Numazaki* and the knowledge of a PHOSITA should be vacated because it is not supported by substantial evidence; therefore, the Board's finding that dependent claims 2, 4-6, 8-10, 12-14, 16, 18-20, 22, 24-26, and 28-30 of the '079 Patent are unpatentable should be vacated for at least the same reasons.

C. The Board Improperly Construed Operation of the Light Source in Dependent Claims 3, 15, and 23.

Dependent claim 3 recites, in part, "wherein the light source includes a plurality of light emitting diodes." Appx0044 (13:12-13). The Board concluded that claim 3 "should be read according to its plain and ordinary meaning. In other words, 'the light source includes a plurality of light emitting diodes,' simply means exactly what it says 'the light source includes a plurality of light emitting diodes.'" Appx0009. That conclusion is erroneous.

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Independent claim 1 recites "a light source adapted to direct illumination through a work volume . . . [a] gesture performed in the work volume and illuminated by the light source." '079 Patent, claim 1. By virtue of its dependency from independent claim 1, dependent claim 3 includes all the limitations of independent claim 1. 35 U.S.C. § 112(d) ("A claim in dependent form shall be construed to incorporate by reference all the limitations of the claim to which it refers."). Accordingly, dependent claim 3 requires that the performed gesture be illuminated by a light source having multiple LEDs.

In view of the claim language alone, the most straightforward meaning of that requirement is that the multiple LEDs are all active at the same time (i.e., all LEDs emitting light at the same time) to illuminate the performed gesture. Indeed claim 3 requires that the performed gesture be illuminated by the light source, <u>not</u> a portion of the light source.

This interpretation is consistent with the specification, which describes at least one purpose of the light source as increasing the amount of light incident to the object (e.g., finger) performing the gesture. Appx0039 (3:1-3) ("Light from below, such as provided by [the light source] can be used to illuminate the finger that typically looks bright under such illumination"). By having the multiple LEDs emit light at the same time (as opposed to only one LED emitting light at a given time), the object (e.g., finger) performing the gesture will appear brighter, which increases the

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accuracy of the gesture recognition. That is a why a PHOSITA would interpret claim 3 to require the multiple LEDs of the light source be active at the same time. *See* Appx1379-1380 (¶ 40-42).

The specification does not support construing this term to require that only one LED of the plurality be used to illuminate the gesture. Further, construing this term to require that only one LED of the plurality be used to illuminate the gesture would render claim 3 superfluous in view of claim 2. *Compare* claim 3 with claim 2 ("wherein the light source includes a light emitting diode"). Moreover, including extra LEDs in the light source that are not used for illumination would be nonsensical because doing so would only increase circuit complexity and cost of the light source with no additional benefit. *See* Appx1379-1380 (¶ 40-42).

In view of the foregoing, the Board's improper construction of claim 3 should be vacated. Dependent claims 15 and 23 are similar to claim 3. *See* Appx0023 ("claim 3 depends from claim 1 and adds 'wherein the light source includes a plurality of light emitting diodes.' Claims 15 and 23 add the same limitation to their respective independent claims."). Accordingly, the Board's improper construction of claims 15 and 23 should be vacated for the same reasons.

D.   The Board Erred in Determining That *Numazaki* and *Numazaki '863* Render Obvious Dependent Claims 3, 15, and 23.

Dependent claim 3 recites "wherein the light source includes a plurality of light emitting diodes." As discussed above, under a proper claim construction, claim

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3 requires that the light source illuminate the gesture by having the multiple LEDs of the light source emit light at the same time. *See supra* VII.C.

The Petition concedes that *Numazaki* fails to disclose that the light source includes a plurality of LEDs. Appx0086-0088. The Petition attempts to address this shortcoming in *Numazaki* by combining it with *Numazaki '863*. *Id*. But *Numazaki '863* also does not teach or suggest this claim limitation.

Numazaki '863 teaches a range finder having an array of LEDs arranged in rows and columns. Appx0821 (16:36-57). The LEDs in the array "are *sequentially* driven" to "generate two-dimensional distance data of the object" in front of the range finder. *Id.* (emphasis added). In other words, *Numazaki '863* teaches that only one LED is emitting light at a given time. This is unsurprising because if multiple LEDs were on at the same time, multiple reflected beams would be received by the range finder at the same time making it impossible for the range finder to distinguish between the multiple reflected beams. Without that sequential operation, the range finder would not be able to determine the distances to different points on the object in front of the range finder. *See* Appx1395 (¶ 78). *Numazaki '863* even acknowledges this. Appx0821 (16:50-53) ("It follows that the range finder can generate two-dimensional distance data of the object 23 *only if* the LEDs 22 are *sequentially driven* and the PSD receives the beams reflected from the object 23.") (emphasis added).

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Accordingly, under the proper claim construction, *Numazaki '863*, like *Numazaki*, does not teach or suggest this claim limitation. The FWD's finding that the combination of *Numazaki* and *Numazaki '863* teaches this claim element is not supported by substantial evidence. Accordingly, the Board's determination that the combination of *Numazaki* and *Numazaki '863* renders claim 3 obvious should be vacated.

Dependent claims 15 and 23 recite limitations that are similar to dependent claim 3. Appx0023 ("claim 3 depends from claim 1 and adds 'wherein the light source includes a plurality of light emitting diodes.' Claims 15 and 23 add the same limitation to their respective independent claims.") *Compare* claim 3 *with* claim 15 and claim 23. Accordingly, under the proper claim construction, the FWD's findings that the combination of *Numazaki* and *Numazaki '863* teach those limitations are not supported by substantial evidence. The Board's determination that the combination of *Numazaki* and *Numazaki '863* renders claims 15 and 23 obvious should be vacated.

E.   The USPTO Does Not Have Jurisdiction Over Expired Patents

In *Oil States*, the Supreme Court explained that the "decision to *grant* a patent is a matter involving public rights—specifically, the grant of a public franchise." *Oil States Energy Servs., LLC v. Greene's Energy Grp., LLC*, 138 S. Ct. 1365, 1373 (2018). "Specifically, patents are public franchises that the Government grants to

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the inventors of new and useful improvements." *Id.* (internal quotation marks

omitted). The Court explained that "Congress [has] significant latitude to assign

[the] adjudication of public rights to entities other than Article III courts." *Id.* at

1368. In exercising its "significant latitude," Congress grants public franchises

"subject to the qualification that the PTO has the authority to reexamine—and

perhaps cancel—a patent claim in an inter partes review." *Id.* at 1368, 1374 (internal

quotation marks omitted). Accordingly, so long as the public franchise exists, the

Patent Office may have jurisdiction to amend and cancel the claims of the patent

(e.g., via *inter partes* review).

When a patent expires, however, the public franchise ceases to exist and the

franchisee (e.g., the patent owner) no longer has the right to exclude others. At most,

the franchisee may be entitled to collect damages from the public franchise that

formerly existed through an infringement action in district court. But because the

public franchise no longer exists after the patent expires, the Patent Office has

nothing in its authority to cancel or amend. Expiration removes the patent from the

Patent Office's jurisdiction and returns it to the sole jurisdiction of the Article III

courts, which have exclusive authority to govern claims for damages. If this were

not so, the Patent Office would purport to have authority to retroactively modify a

public franchise that no longer exists, in a setting where the expired public franchise

does not enjoy any presumption of validity and in which amendment of claims is no longer permitted.

The '079 Patent issued in October 2013 and expired in November 2019, long before the IPR Petition was filed on April 18, 2021. With the expiration of the '079 Patent in November 2019, the Board ceased to have jurisdiction over the '079 Patent, and the FWD should be vacated as a result.

VIII. CONCLUSION AND RELIEF SOUGHT

For the foregoing reasons, Appellant respectfully submits that the Court should reverse the Board's final written decision in IPR2021-00922. And Patent Owner respectfully submits that the final written decision in IPR2021-00922 should be vacated because the Board does not have jurisdiction over expired patents.

Dated: July 17, 2023   Respectfully submitted,

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CERTIFICATE OF SERVICE

I hereby certify that I electronically filed the foregoing with the Clerk of the Court of the United States Court of Appeals for the Federal Circuit by using the appellate CM/ECF system on July 17, 2023.

I certify that all participants in the case are registered CM/ECF users and that service will be accomplished by the appellate CM/ECF system.

Dated: July 17, 2023   */s/ Fred I. Williams*
                                                                   Fred I. Williams

UNITED STATES COURT OF APPEALS
FOR THE FEDERAL CIRCUIT

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Case Number: 2023-1463

Short Case Caption: Gesture Technology Partners, LLC v. Apple Inc.

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ADDENDUM

UNITED STATES PATENT AND TRADEMARK OFFICE

———————

BEFORE THE PATENT TRIAL AND APPEAL BOARD

———————

APPLE, INC., LG ELECTRONICS, INC.,
LG ELECTRONICS U.S.A., INC., AND GOOGLE LLC,
Petitioner,

v.

GESTURE TECHNOLOGY PARTNERS, LLC,
Patent Owner.

———————

IPR2021-00922[1]
Patent 8,553,079 B2

———————

Before KEVIN F. TURNER, JONI Y. CHANG, and
BRENT M. DOUGAL, *Administrative Patent Judges*.

DOUGAL, *Administrative Patent Judge*.

JUDGMENT
Final Written Decision
Determining Some Challenged Claims Unpatentable
35 U.S.C. § 318(a)

———————

[1] IPR2022-00090 (LG Electronics, Inc. and LG Electronics U.S.A., Inc.) and
IPR2022-00360 (Google LLC) have been joined with this proceeding.

IPR2021-00922
Patent 8,553,079 B2

I.   INTRODUCTION

A.   Background

Applying the standard set forth in 35 U.S.C. § 314(a), we instituted an *inter partes* review challenging the patentability of claims 1–30 (the "challenged claims") of U.S. Patent No. 8,553,079 B2 (Ex. 1001, "the '079 patent"). Paper 10 ("Dec."). Apple, Inc.[2] filed the request for an *inter partes* review (Paper 1, "Petition" or "Pet."), which Patent Owner, Gesture Technology Partners, LLC, opposed (Paper 8).

After institution, Patent Owner filed a Response (Paper 13, "PO Resp."), Petitioner filed a Reply (Paper 17, "Reply"), and Patent Owner filed a Sur-reply (Paper 18, "Sur-reply"). An oral hearing was held on September 13, 2022, and a copy of the transcript was entered into the record. Paper 25 ("Tr.").

We have jurisdiction under 35 U.S.C. § 6. This Decision is a Final Written Decision under 35 U.S.C. § 318(a) and 37 C.F.R. § 42.73 as to the patentability of the claims on which we instituted trial. Having reviewed the arguments of the parties and the supporting evidence, we determine that Petitioner has shown by a preponderance of the evidence, that claims 1–6, 8–16, 18–26, and 28–30 are unpatentable. We also determine that Petitioner has not shown that claims 7, 17, and 27 are unpatentable.

B.   Related Matters

The parties identify these related matters: *Gesture Technology Partners, LLC v. Huawei Device Co., Ltd.*, No. 2:21-cv-00040 (E.D. Tex.); *Gesture Technology Partners, LLC v. Samsung Electronics Co.*, No. 2:21-

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[2] Apple, Inc., LG Electronics, Inc., LG Electronics U.S.A., Inc., and Google LLC are collectively referred to herein as "Petitioner."

IPR2021-00922
Patent 8,553,079 B2

cv-00041 (E.D. Tex.); *Gesture Technology Partners, LLC v. Apple Inc.*, No.
6:21-cv-00121 (W.D. Tex.); *Gesture Technology Partners, LLC v. Lenovo
Group Ltd.*, No. 6:21-cv-00122 (W.D. Tex.); *Gesture Technology Partners,
LLC v. LG Electronics, Inc.*, No. 6:21-cv-00123 (W.D. Tex.); *Gesture
Technology Partners, LLC v. Motorola Mobility LLC*, No. 1:22-cv03535
(ND Ill.); and *Gesture Technology Partners, LLC v. Katherine K. Vidal*, No.
1:22-cv-622 (E.D. VA). Pet. 77; Paper 20, 2–3. Patent Owner also identifies
the following related *Ex Parte* Reexaminations: No. 90/014,900; No.
90/014,901; No. 90/014,902; and No. 90/014,903. Paper 20, 3–4.

 C. *The '079 Patent*

 The '079 patent relates to "[a] method for determining a gesture,"
such as a hand or finger gesture, using a camera and a light source, where
the gesture serves as an input for a computer. Ex. 1001, Abstract, 1:54–57,
1:64–2:2. Figure 2, reproduced below, depicts an embodiment in which a
computer device (e.g., laptop) includes this method.
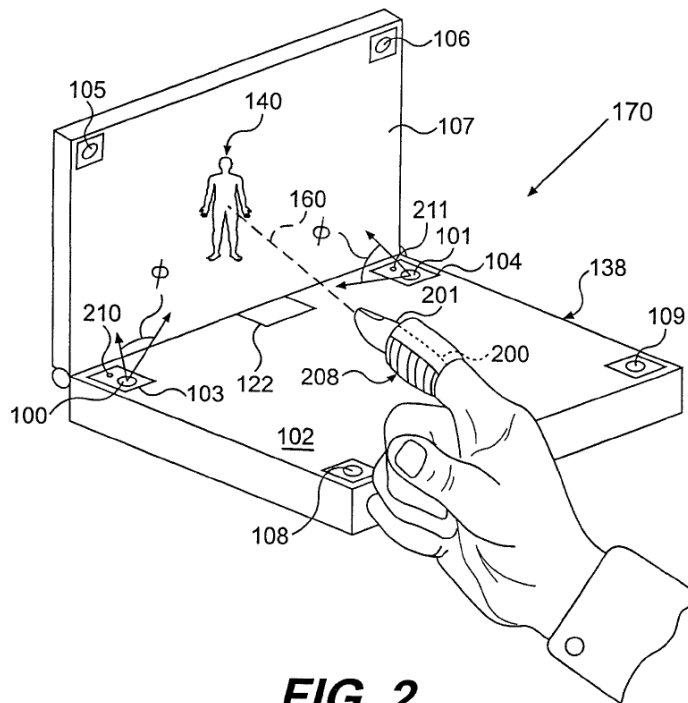
FIG. 2

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As illustrated in Figure 2, a laptop (138) may include camera locations (100, 101, 105, 106, 108, 109), a keyboard surface (102), a screen housing (107), a light (122), light emitting diodes (LEDs) (210, 211), and a work volume area (170) within which a user's movements are detected. *Id.* at 2:39–53. The system can detect a user's finger alone or the user may employ external objects such as a ring (208) to help detect and recognize gestures performed in the work volume area (170). *Id.* at 2:54–3:8. The '079 patent describes detecting point, pinch, and grip gestures using this configuration. *Id.* at 2:54–61, 3:48–51.

> ### D.   *Illustrative Claim*

Petitioner challenges claims 1–30 of the '079 patent. Claims 1, 11, and 21 are independent. Claim 1 is illustrative:

> 1. A computer implemented method comprising:
>
>> providing a light source adapted to direct illumination through a work volume above the light source;
>>
>> providing a camera oriented to observe a gesture performed in the work volume, the camera being fixed relative to the light source; and
>>
>> determining, using the camera, the gesture performed in the work volume and illuminated by the light source.

Ex. 1001, 13:2–9.

II.   ANALYSIS

> ### A.   *Summary of Issues*

In the below analysis, we first address the grounds of unpatentability. We then address Patent Owner's jurisdiction argument.

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B. Instituted Grounds

Petitioner asserts the following grounds of unpatentability (Pet. 5), supported by the declaration of Dr. Benjamin B. Bederson (Ex. 1010):

Claim(s) Challenged	35 U.S.C. §	Reference(s)/Basis
1, 2, 4–14, 17, 19, 21, 22, 24–28, 30	103(a)[3]	Numazaki,[4] Knowledge of a PHOSITA[5]
3, 15, 23	103(a)	Numazaki, Numazaki '863[6]
16, 29	103(a)	Numazaki, DeLuca[7]
18	103(a)	Numazaki, DeLeeuw[8]
20	103(a)	Numazaki, Maruno[9]

1. Legal Standards for Unpatentability

Petitioner bears the burden to demonstrate unpatentability. *Dynamic Drinkware, LLC v. Nat'l Graphics, Inc.*, 800 F.3d 1375, 1378 (Fed. Cir. 2015).

A claim is unpatentable as obvious under 35 U.S.C. § 103 if "the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains." *KSR Int'l Co. v. Teleflex Inc.*, 550 U.S. 398, 406 (2007) (quoting 35 U.S.C. § 103(a)). We resolve the question of

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[3] The Leahy-Smith America Invents Act ("AIA"), Pub. L. No. 112-29, 125 Stat. 284, 285–88 (2011), revised 35 U.S.C. § 103 effective March 16, 2013. Because the challenged patent was filed before March 16, 2013, we refer to the pre-AIA versions.
[4] U.S. Patent 6,144,366, issued Nov. 7, 2000 ("Numazaki") (Ex. 1004).
[5] A person of ordinary skill in the art ("PHOSITA").
[6] U.S. Patent 5,900,863, issued May 4, 1999 ("Numazaki '863") (Ex. 1005).
[7] U.S. Patent 6,064,354, issued May 16, 2000 ("DeLuca") (Ex. 1006).
[8] U.S. Patent 6,088,018, issued July 11, 2000 ("DeLeeuw") (Ex. 1007).
[9] U.S. Patent 6,191,773 B1, issued Feb. 20, 2001 ("Maruno") (Ex. 1008).

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obviousness based on underlying factual determinations, including: (1) the scope and content of the prior art; (2) any differences between the prior art and the claims; (3) the level of skill in the art; and (4) when in evidence, objective indicia of nonobviousness.[10] *See Graham v. John Deere Co.*, 383 U.S. 1, 17–18 (1966).

We apply these principles to the Petition's challenges.

2. *Level of Ordinary Skill in the Art*

Petitioner asserts that "[a] person having ordinary skill in the art ('PHOSITA') at the time of the '079 Patent would have had at least a bachelor's degree in electrical engineering or equivalent with at least one year of experience in the field of human computer interaction" and that "[a]dditional education or experience might substitute for the above requirements." Pet. 4 (citing Ex. 1010 ¶¶ 29–31). Patent Owner does not dispute Petitioner's level of ordinary skill in the art. PO Resp. 6.

We are persuaded that Petitioner's declarant's statement is consistent with the problems and solutions in the '079 patent and prior art of record. We adopt this definition for the purposes of this Final Decision.

3. *Claim Construction*

In *inter partes* review, we construe claims using the same claim construction standard that would be used to construe the claims in a civil action under 35 U.S.C. § 282(b), including construing the claims in accordance with the ordinary and customary meaning of such claims as understood by one of ordinary skill in the art and the prosecution history pertaining to the patent. 37 C.F.R. § 42.100(b) (2020).

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[10] Neither party presents evidence or arguments regarding objective evidence of nonobviousness in the instant proceeding.

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Patent Owner proposes a construction for a term in claims 3, 15, and 23. PO Resp. 6–8. The parties do not propose any other any claim constructions. Pet. 5–6; PO Resp. 6. We address the term "a plurality of light emitting diodes" in claims 3, 15, and 23 below. To the extent any other term needs construction, we address the term in the later arguments below. *See Realtime Data, LLC v. Iancu*, 912 F.3d 1368, 1375 (Fed. Cir. 2019) ("The Board is required to construe 'only those terms . . . that are in controversy, and only to the extent necessary to resolve the controversy.'" (quoting *Vivid Techs., Inc. v. Am. Sci. & Eng'g, Inc.*, 200 F.3d 795, 803 (Fed. Cir. 1999)).

a)   A Plurality of Light Emitting Diodes

Patent Owner proposes that "wherein the light source includes a plurality of light emitting diodes," in claim 3, be construed to mean "the light source illuminates the gesture by having two or more (i.e., a plurality) LEDs of the light source emit light at the same time." PO Resp. 6–8. Patent Owner argues that the similar limitations in claims 15 and 23 should also be construed in this way. *Id.* at 8.

Patent Owner argues that claim 1, from which claim 3 depends, "requires that the gesture performed in the work volume is illuminated by the light source, not a portion of the light source. As a result, the 'plurality of light emitting diodes' recited in claim 3 must illuminate the work volume, not a subset of the LEDs." *Id.* at 7.

Patent Owner's argument is inconsistent. As quoted above, Patent Owner says that a subset of LEDs cannot illuminate the work volume, but Patent Owner's argued-for-construction would only require two LEDs to emit light at the same time, even if the system had three or more. Thus, this argument does not support Patent Owner's argued-for-construction.

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Claim construction starts with an analysis of the claim language itself. *Sjolund v. Musland*, 847 F.2d 1573, 1582 (Fed. Cir. 1988) ("[T]he claims define the invention."). Claim 1 includes "providing a light source adapted to direct illumination through a work volume above the light source," a "camera being fixed relative to the light source," and "determining . . . the gesture performed in the work volume and illuminated by the light source." Ex. 1001, 13:3–9. Claim 3 adds that "the light source includes a plurality of light emitting diodes." *Id.* at 13:12–13.

Reading claims 1 and 3 it can be seen that Patent Owner's construction is not apparent or implied from the claim language. Neither claim requires, for example, that the gesture be illuminated by 100% of the light source, or by at least two LEDs of the light source. Claim 1 merely states that the gesture be "illuminated by the light source." The amount of illumination is not specified.

Patent Owner also argues that the purpose for having multiple light emitting diodes from the Specification should be read into the claims. PO Resp. 7. "Claim 3, when read in light of the specification, means the light source illuminates the gesture by having two or more (i.e., a plurality) LEDs of the light source emit light at the same time." *Id.*; *see also id.* ("the specification, . . . describes the purpose of the light source as increasing the amount of light incident to the object (e.g., finger) performing the gesture. Ex. 1001, 3:1-3").

The mere fact that the Specification provides an example as to how the light source is used is not a sufficient reason for us to read a limitation into the claims from the Specification. If the specification "reveal[s] a special definition given to a claim term by the patentee that differs from the meaning it would otherwise possess[,] . . . the inventor's lexicography

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governs." *Phillips v. AWH Corp.*, 415 F.3d 1303, 1316 (Fed. Cir. 2005) (en banc) (citing *CCS Fitness, Inc. v. Brunswick Corp.*, 288 F.3d 1359, 1366 (Fed. Cir. 2002)); *see also* Reply 19. However, this is not the case here. Patent Owner does not identify anywhere in the Specification where "light source" or "plurality of light emitting diodes" are defined as "the light source illuminates the gesture by having two or more (i.e., a plurality) LEDs of the light source emit light at the same time."

For these reasons we decline to adopt Patent Owner's claim construction. We determine that the added limitation in claims 3, 15, and 23 should be read according to its plain and ordinary meaning. In other words, "the light source includes a plurality of light emitting diodes," simply means exactly what it says "the light source includes a plurality of light emitting diodes."

4. Obviousness over Numazaki and Knowledge of a PHOSITA

Petitioner argues that Numazaki in view of the knowledge of a PHOSITA would have rendered obvious claims 1, 2, 4–14, 17, 19, 21, 22, 24–28, and 30. Pet. 6–35. Patent Owner specifically contends that Numazaki does not disclose all the limitations of claims 1, 7, 11, 17, 21, and 27. PO Resp. 8–20.

We first give an overview of the asserted prior art, Numazaki. This is followed by a discussion of Petitioner's positions and Patent Owner's arguments in response where we conclude that Petitioner has shown by a preponderance of the evidence that some of the challenged claims are unpatentable.

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a)   *Numazaki*

Numazaki "relates to a method and an apparatus for generating information input in which input information is extracted by obtaining a reflected light image of a target object." Ex. 1004, 1:8–11.

Figure 1, reproduced below, depicts a block diagram for an information input generation apparatus.

FIG.1
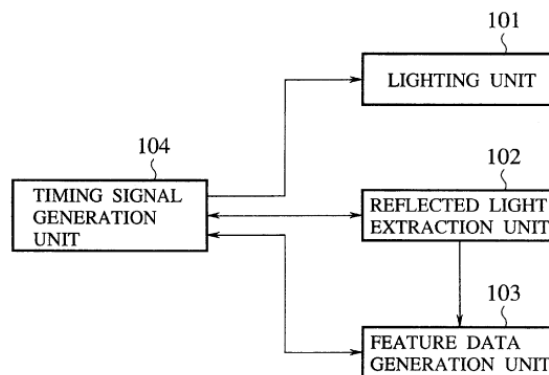
Figure 1 shows that an information input generation apparatus includes a lighting unit (101), a reflected light extraction unit (102), a feature data generation unit (103), and a timing signal generation unit (104). *Id.* at 10:23–28. Numazaki describes emitting light from the light emitting unit (101) and that the intensity of the light varies in time according to a timing signal from the timing signal generation unit (104). *Id.* at 10:29–31. The light is directed onto a target object and light reflected from the target object is extracted by the reflected light extraction unit (102). *Id.* at 10:31–35. Numazaki teaches that the feature data generation unit (103) extracts feature data from the reflected light image. *Id.* at 10:57–61. Numazaki further teaches operating a computer based on information obtained from the feature data. *Id.* at 10:61–66.

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Figure 2, reproduced below, shows a more detailed block diagram of an embodiment of information input generation apparatus.

FIG.2
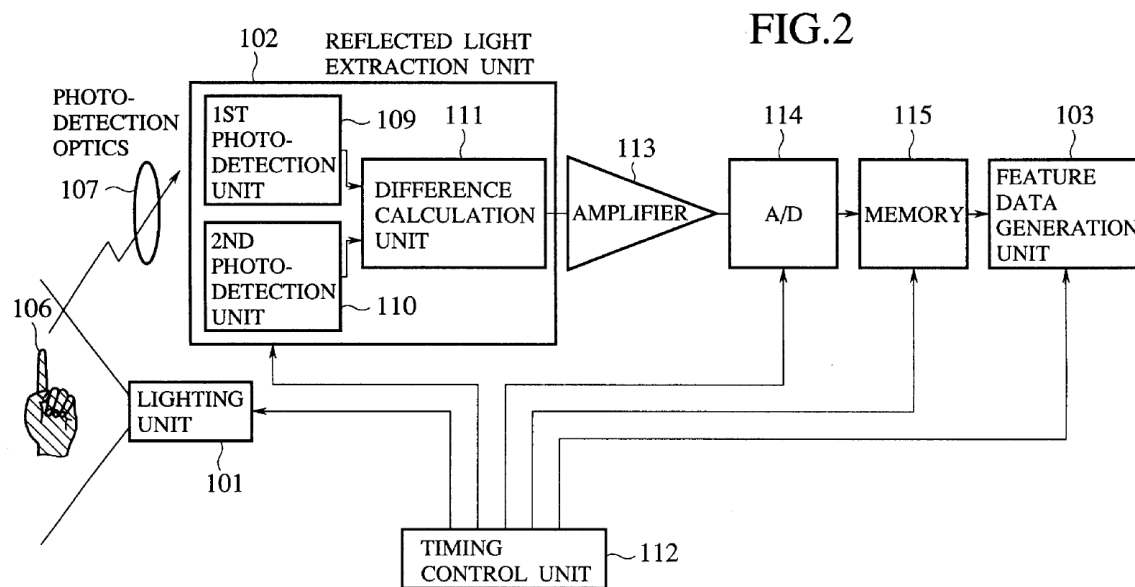
In Figure 2, a timing control unit (112) is used to turn the lighting unit (101) on (i.e., illuminating the target object) when the first photo detection unit (109) is active and off when the second photo detection unit (110) is active. *Id.* at 11:20–32. The first photo detection unit captures an image of the target object illuminated by both natural light and the lighting unit and the second photo detection unit captures an image of the target object illuminated by only natural light. *Id.* at 11:33–39. The difference between the two images— obtained by a difference calculation unit (111)—represents the "reflected light from the object resulting from the light emitted by the lighting unit 101." *Id.* at 11:43–51. This information is then used by the feature data generation unit (103) to determine gestures, pointing, etc. of the target object that may be converted into commands executed by a computer. *Id.* at 10:57–66.

Figure 74, reproduced below, illustrates a system incorporating an information input generation apparatus.

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FIG.74
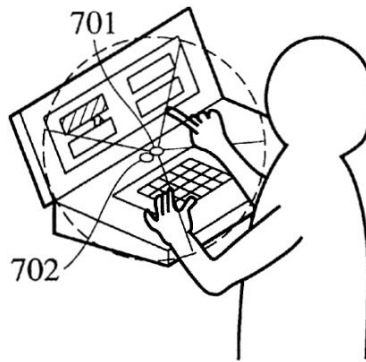
Figure 74 shows a portable computer with an information input generation device. *Id.* at 50:25–29. The device includes a lighting unit (701) and a photo-detection sensor unit (702). *Id.* at 50:29–35. Numazaki teaches that "the operator operating the keyboard can make the pointing or gesture input by slightly raising and moving the index finger." *Id.* at 50:38–40.

  b) *Claim 1*

Petitioner relies on Numazaki in view of the knowledge of a PHOSITA for teaching or suggesting all of the elements of claim 1. Pet. 10–14. For example, Petitioner relies on the portable computer with an information input generation device of Figure 74 with its lighting unit (701) and photo-detection sensor unit (702) for the providing a computer, light source, and camera, method steps of claim 1. *Id.* at 10–13.

Petitioner further argues that the determining step is taught by Numazaki, where the lighting and photo-detection sensor units are used to determine a hand gesture in the area above the laptop. *Id.* at 12–13 (citing Ex. 1004, 50:30–43).

Numazaki only provides some details about the photo-detection sensor unit. *See generally* Ex. 1004, 50:25–54:6. However, Petitioner relies on Numazaki's teaching that "light and camera arrangement" of Figure 2 "is

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incorporated into the eighth embodiment" for more details about the photo-detection sensor unit. Pet. 13–14; *see also id.* at 9 (quoting Ex. 1004, 50:21–24) ("*Numazaki* teaches that its eighth embodiment incorporates 'the information input generation apparatus of the present invention as described in the above embodiments.'"); Ex. 1010 ¶¶ 42–43 (discussing what a PHOSITA would have understood was incorporated into the eighth embodiment); Ex. 1004, 53:22–36 (Numazaki discussing "the photo-detection section" and then pointing to the prior discussion "as already described in detail above"). Petitioner describes Numazaki as teaching a system where two images are obtained of the target object by two different cameras, one with the lighting unit on and one with it off. Pet. 14 (citing Ex. 1007, 11:20–39). The images are compared to obtain certain information. *Id.* (citing Ex. 1007, 11:43–51). Petitioner concludes that the obtained "information is then used by feature data generation unit 103 to determine gestures, pointing, etc. of the target object that may be converted into commands executed by a computer" and that this all reads on the determining step of claim 1. *Id.* (citing Ex. 1007, 10:57–66).

Patent Owner argues that Numazaki does not teach the steps of "providing a camera" or "determining a gesture" in claim 1. PO Resp. 8–13. We address each argument in turn below.

(1)   *Providing a Camera*

Claim 1 requires "providing a camera oriented to observe a gesture performed in the work volume, the camera being fixed relative to the light source." Ex. 1001, 13:5–7. As noted above, Petitioner relies on Numazaki's portable computer with an information input generation device of Figure 74 with its photo-detection sensor unit (702) for the providing a camera method step of claim 1. Pet. 12–13. The Petition further relies on Numazaki's

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teaching that "light and camera arrangement" of Figure 2 "is incorporated into the eighth embodiment" for more details about the photo-detection sensor unit. *Id.* at 13–14; *see also id.* at 9 (quoting Ex. 1004, 50:21–24) ("*Numazaki* teaches that its eighth embodiment incorporates 'the information input generation apparatus of the present invention as described in the above embodiments.'"); Ex. 1010 ¶¶ 42–43 (discussing what a PHOSITA would have understood was incorporated into the eighth embodiment); Ex. 1004, 53:22–36 (Numazaki discussing "the photo-detection section" and then pointing to the prior discussion "as already described in detail above"). We determine that Petitioner has shown by a preponderance of the evidence that this limitation is taught by Numazaki.

Neither Patent Owner, nor Patent Owner's declarant, contest Petitioner's position, supported by its declarant, that Numazaki's reflected light extraction unit, with its two photo detection units in Figure 2 teach a camera. *See* PO Resp. 10 (citing Pet. 6, 7, 12–14; Ex. 1010 ¶¶ 35–36) (acknowledging Petitioner's position and declarant support); Ex. 2004 ¶ 50 (Patent Owner's declarant acknowledging Petitioner's position and declarant support).

However, Patent Owner argues that "[n]one of embodiments 1–7 in Numazaki [(including Figure 2)] mention a 'photo-detection sensor unit,' and thus none of embodiments 1–7 teach or suggest the 'photo-detection sensor unit' in Fig. 74 as being a camera." PO Resp. 9 (citing Ex. 2002 ¶ 48). Patent Owner admits that Numazaki Figure 2 teaches two "photo-detection units," but essentially argues that because the term "photo-detection unit" is not identical to Figure 74's "photo-detection sensor unit," one of skill in the art would not understand what a "photo-detection

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sensor unit" is, or how it relates to the rest of the disclosure. *Id.* at 9, 11; *see also* Sur-reply 1–2.

In support, Patent Owner relies on its declarant who testifies: "I reviewed Numazaki in its entirety and it contains no disclosure stating that the 'photo-detection sensor unit' is a camera" and "it is my opinion that a POSITA would understand that none of embodiments 1–7 disclose the 'photo-detection sensor unit' in Fig. 74 as being or including a camera." Ex. 2002 ¶ 48.

As will be understood from reviewing Numazaki, Numazaki discloses an eighth embodiment having a number of different portable form factors shown in Figures 74–79, but sharing "a system configuration incorporating the information input generation apparatus of the present invention as described in the above embodiments," i.e., embodiments 1–7, including Figure 2. Ex. 1004, 50:19–20; *see also* Ex. 1010 ¶ 40. In addition to referring back to the prior disclosure, additional details of the information input generation apparatus including the photo-detection section are provided at 52:33–54:6. This section not only describes an information input generation apparatus that is very similar to the disclosure of Figure 2, but it again refers back to the "the photo-detection section . . ., as already described in detail above." *Id.* at 53:22–36; *see also* Dec. 9 (explaining that "details about the photo-detection sensor unit" could be found at Ex. 1004, 50:25–54:6).

Thus, the position of Patent Owner and Patent Owner's declarant is inconsistent with the express disclosure of Numazaki that makes clear that the photo-detection section of the eighth embodiment, including the "photo-detection sensor unit" of Figure 74 incorporates the disclosure of the photo-detection section of the prior embodiments, including Figure 2. Thus,

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we determine that one of ordinary skill in the art would have understood Numazaki to teach that the "photo-detection sensor unit" in Figure 74 is or at least includes a camera, just as Numazaki's reflected light extraction unit, with its two photo detection units in Figure 2 teach a camera.

For the above reasons, Patent Owner's arguments do not identify any shortcomings in the showing by Petitioner that Numazaki teaches providing a camera.

(2)   Determining the Gesture

Claim 1 also requires "determining, using the camera, the gesture performed in the work volume and illuminated by the light source." Ex. 1001, 13:8–9. As noted above, Petitioner relies on Numazaki to teach this step, where Numazaki's lighting and photo-detection sensor units are used to determine a hand gesture in the area above the laptop. Pet. 12–13 (citing Ex. 1004, 50:30–43). Petitioner further relies on Numazaki's teaching that "light and camera arrangement" of Figure 2 "is incorporated into the eighth embodiment" for more details about the photo-detection sensor unit. *Id.* at 13–14; *see also id.* at 9 (citing Ex. 1010 ¶¶ 42–43). We determine that Petitioner has shown by a preponderance of the evidence that this limitation is taught by Numazaki.

Patent Owner argues that this limitation is not taught because "[a] POSITA would interpret [it] . . . as requiring the gesture be illuminated by the light source while the camera is capturing one or more images of the gesture." PO Resp. 11 (citing Ex. 2002, ¶ 52; Ex. 1001, Abst., 3:1–8). Patent Owner then puts forth two positions based on whether "a camera" in the prior limitation means "only one camera" or "multiple cameras." *Id.* at 12.

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Patent Owner's first argument is that if "providing a camera" means "providing only one camera," Numazaki teaches two and thus does not teach only one. *Id.* at 12.

Unless a more limited construction is indicated by the specification or prosecution history, the indefinite article "a" or "an" is construed in a claim to mean "one or more." *KCJ Corp. v. Kinetic Concepts, Inc.*, 223 F.3d 1351, 1356 (Fed. Cir. 2000). Thus, "providing a camera" is not limited to one interpretation or the other, but can include one camera or multiple cameras.[11] As the claim is not limited to "only one camera," Patent Owner's argument does not identify any shortcomings in Petitioner's showing.

Patent Owner then argues that if "a camera" means "multiple cameras," Numazaki fails to teach the limitation because the claim

> requires the gesture be illuminated by the light source when any of the cameras is capturing an image of the gesture. But as discussed above, Numazaki requires two photo-detection units (i.e., two cameras) and Numazaki's lighting unit (i.e., light source) is *not* active when one of the photodetection units is capturing an image of the gesture.

PO Resp. 12.

However, claim 1 does not require or refer to capturing images. It is not clear why Patent Owner is arguing that a person of ordinary skill in the art would interpret the claim as requiring the capturing of images when that is not claimed. Patent Owner does not further explain this position.

The claim does require that the gesture be "illuminated by the light source," but Patent Owner admits that this is taught by Numazaki. *Id.* Patent Owner states that "Numazaki requires two photo-detection units (i.e., two

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[11] Patent Owner disavows this argument in the Sur-reply when it agrees that "'a camera' . . . should be construed as 'one or more cameras.'" Sur-reply 3.

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cameras) and Numazaki's lighting unit (i.e., light source) is *not* active when one of the photodetection units is capturing an image of the gesture." *Id.*

The claim does not require that the gesture remain permanently illuminated. Further, the fact that Numazaki also teaches a second photo-detection unit that captures the gesture while lighting unit 101 is not active is not excluded by the language of the claim. The fact that Numazaki compares both images in determining the gesture is also not excluded by the claim. The claim merely requires that the determining be made "using the camera," that "the gesture [be] performed in the work volume" and that the gesture be "illuminated by the light source" at some point in time. Claim 1 uses the term "comprising" to create an "open ended" claim. "'Comprising' is a term of art used in claim language which means that the named elements are essential, but other elements may be added and still form a construct within the scope of the claim." *Genentech, Inc. v. Chiron Corp.*, 112 F.3d 495, 501 (Fed. Cir. 1997). Thus, the additional steps taught by Numazaki highlighted by Patent Owner are not excluded from the claim.

For the above reasons, Patent Owner's arguments do not undermine the showing by Petitioner that Numazaki teaches all of the aspects of the determining a gesture claim element.

(3)   Conclusion

After review of the arguments and evidence, and further in view of the above discussion, we determine that Petitioner has shown, by a preponderance of the evidence, that claim 1 is unpatentable over Numazaki and the knowledge of a PHOSITA.

c)   Claims 11 and 21

Independent claim 11 is directed to a computer apparatus and is very similar to method claim 1. *Compare* Ex. 1001, 13:31–39, *with id.* at 13:1–9.

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Independent claim 21 is directed to a computer implemented method and is very similar to method claim 1. *Compare id.* 14:14–22, *with id.* at 13:1–9. As such, the Petition relies on essentially the same teachings of Numazaki discussed above with respect to claim 1 for the features of claims 11 and 21, which we agree with for the reasons explained above. *See* Pet. 28–30, 33.

Similarly, Patent Owner argues that the Petition fails to teach or suggest the claim elements of claims 11 and 21 "for the same reasons above with respect to claim [1]." PO Resp. 16–17, 18–19. Patent Owner then briefly reiterates some of the same arguments discussed above. *Id.* Patent Owner does not provide any additional argument other than what has already been addressed with respect to claim 1 above.

After review of the arguments and evidence, and further in view of the above discussion, we determine that Petitioner has shown, by a preponderance of the evidence, that claims 11 and 21 are unpatentable over Numazaki and the knowledge of a PHOSITA.

d)   *Claims 7, 17, and 27*

Claims 7, 17, and 27 depend from claims 1, 11, and 21, respectively and are very similar in scope:

> 7. . . . providing a target positioned on a user that is viewable in the work volume.

> 17. . . . including a target that is viewable by the camera when in the work volume.

> 27. . . . providing a target positioned on the user that is viewable by the camera.

Ex. 1001, 13:21–23, 14:5–7, 14:35–37.

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Petitioner argues[12] that Numazaki teaches using a hand within the work volume. Pet. 22–23 (citing Ex. 1004, 10:57–66, 50:35–37, Figs. 74, 77). Petitioner also argues that Numazaki recognizes "that it was known to paint a fingertip or to wear a ring in a particular color to improve detection." *Id.* at 23 (citing Ex. 1004, 3:4–11). Petitioner argues that in view of these teachings in Numazaki, "[a] PHOSITA would have understood . . . that the Fig. 74 arrangement described in the eighth embodiment [of Numazaki] is particularly well suited to a ring or other small target mounted on a user's finger." *Id.* (citing Ex. 1010 ¶¶ 48–49).

Petitioner acknowledges, however, that Numazaki "cautions that requiring users to wear or mount some external component may negatively impact the user's convenience and may bring with it durability issues." *Id.* (citing Ex. 1004, 3:32–38). Petitioner relies on the testimony of its declarant to support its position that "users would accept" the tradeoff "of improved accuracy in exchange for the minor inconvenience of wearing a small ring or other hand-based target when using gesture recognition while typing." *Id.* (citing 1010 ¶¶ 48–49). Further, Petitioner argues that "the durability concerns are implicated by a ring target, and many adults wear rings routinely while typing with no ill effect, which suggests that such a tradeoff would be acceptable to many users." *Id.* at 23–24 (citing 1010 ¶¶ 48–49).

Patent Owner argues[13] that the portions of Numazaki that Petitioner discusses, identifying the user's inconvenience and durability issues

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[12] Petitioner relies on the same positions laid out with respect to claim 7 for claims 17 and 27. Pet. 33, 34.
[13] Patent Owner reiterates the main points made with respect to claim 7 to argue over claims 17 and 27. PO Resp. 17–18, 19–20.

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(Ex. 1004, 3:32–38), teach away from using a ring as a target. PO Resp. 13–16.

> A reference may be said to teach away when a person of ordinary skill, upon reading the reference, would be discouraged from following the path set out in the reference, or would be led in a direction divergent from the path that was taken by the applicant. The degree of teaching away will of course depend on the particular facts; in general, a reference will teach away if it suggests that the line of development flowing from the reference's disclosure is unlikely to be productive of the result sought by the applicant.

In re Gurley, 27 F.3d 551, 553 (Fed. Cir. 1994).

Concerning the use of rings and other devices on the hand, Numazaki teaches that they are "not realistic so that they are utilized for experiments but not for practical use" and further:

> the requirement for mounting some element at every occasion of its operation is a *great demerit* from a viewpoint of the *convenience* of the user, and can *limit* its application range *significantly*. Moreover, as can be seen in the example of the data glove, a device that requires to mount some element on the movable part such as hand tends to have a *problem of the durability*.

Ex. 1004, 3:10–11, 3:26–39 (emphasis added).

Patent Owner, supported by the testimony of its declarant, characterizes these teachings as follows:

> Numazaki explicitly criticizes, discredits, and discourages the use of targets (i.e., Numazaki's markers or elements). Accordingly, upon reading Numazaki, a POSITA would be led in a path (i.e., an anti-target path) that diverges from the path in claim 7. Thus, Numazaki teaches away from the subject-matter of claim 7 and does not render claim 7 obvious. *See* Ex. 2002, ¶ 60.

PO Resp. 14.

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At oral argument, Petitioner also characterized the teachings of Numazaki as "disparagement" and "a slight at targets and the historical use of targets in the art." Tr. 28–29. Petitioner further admitted that Numazaki "has strong words about the downsides of targets and those strong words were to set up its own improvement of the art" and that "Numazaki['s] . . . teaching[s] . . . can obviate the need for these targets." *Id.* at 28, 29.

However, even in view of that "disparagement," Petitioner argues that its declarant identified reasons why one of ordinary skill in the art would have accepted certain trade-offs that he identified in using targets which would have rendered adding targets obvious. Reply 15–18.

The testimony of Petitioner's declarant cannot overcome the strong "disparagement" that Petitioner admits Numazaki makes against the use of rings or other added targets. This is not a case where Numazaki merely expresses a general preference for an alternative invention, rather Numazaki clearly criticizes, discredits, and discourages the use of rings and other targets. In Petitioner's own words, "Numazaki['s] . . . teaching[s] . . . can obviate the need for these targets." Tr. 28. Neither Petitioner nor Petitioner's declarant address why one of ordinary skill in the art would have modified Numazaki to use a ring, in view of Petitioner's admission that "Numazaki['s] . . . teaching[s] . . . can obviate the need for these targets." *Id.*

Petitioner also fails to explain how the teachings of Numazaki related to specialized rings supports it conclusion related to a "small [generic] ring," similar to what people routinely wear. Pet. 23–24. Numazaki discusses rings in specialized colors, as well as "color markers," and "light emitting elements." Ex. 1004, 3:7–9, 26–31. Neither Petitioner nor Petitioner's declarant explain the logical steps between Numazaki's disclosure and a "small [generic] ring" similar to what people routinely wear, or why one of

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ordinary skill in the art would have considered them to be the same or similar.

For these reasons, we determine that Petitioner has not shown that claims 7, 17, and 27 are unpatentable.

         e)   *Claims 2, 4–6, 8–10, 12–14, 19, 22, 24–26, 28, 30*

Petitioner argues that Numazaki in view of the knowledge of a PHOSITA would have rendered obvious dependent claims 2, 4–6, 8–10, 12–14, 19, 22, 24–26, 28, and 30. Pet. 14–21, 24–28, 30–35. Patent Owner does not separately contest Petitioner's assertions regarding these claims at this stage. PO Resp. 13, 17, 19.

After review of the arguments and evidence, we determine that Petitioner has shown, by a preponderance of the evidence, that claims 2, 4–6, 8–10, 12–14, 19, 22, 24–26, 28, and 30 are unpatentable over Numazaki.

         5.   *Obviousness over Numazaki and Numazaki '863*

Petitioner argues that the combination of Numazaki and Numazaki '863 would have rendered obvious dependent claims 3, 15, and 23. Pet. 35–42. Patent Owner argues, based on its claim construction, that the combination fails to teach the added limitations in claims 3, 15, 23. PO Resp. 20–22.

As noted previously, claim 3 depends from claim 1 and adds "wherein the light source includes a plurality of light emitting diodes." Claims 15 and 23 add the same limitation to their respective independent claims. We determine previously herein that the added limitation in claims 3, 15, and 23 should be read according to its plain and ordinary meaning. In other words, "the light source includes a plurality of light emitting diodes," simply means exactly what it says "the light source includes a plurality of light emitting diodes."

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Petitioner argues that Numazaki '863 teaches using a plurality of light emitting diodes to illuminate a hand gesture and to control a computer based on the gesture. Pet. 37. Petitioner also identifies a number of reasons to modify Numazaki's light source to use Numazaki's '863's plurality of light emitting diodes as the light sources are used for similar purposes. *Id.* at 38–39.

Patent Owner does not contest Petitioner's positions in the Petition, other than to argue that the combination does not teach the claim limitation under Patent Owner's construction. PO Resp. 20–22. Patent Owner further admits that Numazaki '863 teaches a plurality of light emitting diodes used to illuminate an object. *Id.* at 21 (citing Ex. 1005, 16:36–57, Fig. 4). As we previously rejected Patent Owner's attempt to read limitations from the Specification into the claims, Patent Owner's arguments here do not apply to the requirements of the claims.

We have reviewed Petitioner's assertions with respect to these claims and the supporting evidence, and determine that Petitioner has established by a preponderance of the evidence that claims 3, 15, and 23 are unpatentable.

6. *Obviousness over Numazaki and DeLuca, Numazaki and DeLeeuw, and Numazaki and Maruno*

Petitioner argues that the combination of Numazaki and DeLuca would have rendered obvious dependent claims 16 and 29. Pet. 42–49. Petitioner argues that the combination of Numazaki and DeLeeuw would have rendered obvious dependent claim 18. *Id.* at 49–55. Petitioner argues that the combination of Numazaki and Maruno would have rendered obvious dependent claim 20. *Id.* at 55–68. Patent Owner does not separately address these grounds. *See generally* PO Resp.

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We have reviewed Petitioner's assertions with respect to these claims and the supporting evidence, and determine that Petitioner has established by a preponderance of the evidence that claims 16, 18, 20, and 29 are unpatentable.

C.   Jurisdiction over Expired Patents

Patent Owner argues that the USPTO does not have jurisdiction over expired patents. PO Resp. 1–2. Rather, Patent Owner argues, the USPTO only has jurisdiction over patents with claims that can be amended or cancelled. *Id.* Patent Owner states that, as explained by the Supreme Court, "Congress [has] significant latitude to assign [the] adjudication of public rights to entities other than Article III courts," including for the USPTO to "reexamine—and perhaps cancel—a patent claim in an inter partes review." *Id.* (quoting *Oil States Energy Servs., LLC v. Greene's Energy Grp., LLC*, 138 S. Ct. 1365, 1368, 1374 (2018). However, Patent Owner argues that this authority does not extend to expired patents because the public franchise associated with an issued patent no longer exists after expiration. *Id.* at 2. Thus, it is argued, the USPTO no longer has jurisdiction, even though the patent owner "may be entitled to collect damages" for patent infringement, because "the patent owner[] no longer has the right to exclude others" and the USPTO has nothing to cancel or amend. *Id.*

Patent Owner reasons that:

> Expiration removes the patent from the [US]PTO's jurisdiction and returns it to the sole jurisdiction of the Article III courts, which have exclusive authority to govern claims for damages. If this were not so, the [US]PTO would purport to have authority to retroactively modify a public franchise that no longer exists, in a setting where the expired public franchise does not enjoy any presumption of validity and in which amendment of claims is no longer permitted.

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Id.

Inter partes review of patents, whether expired or not, fits within the USPTO's mandate "for the granting and issuing of patents" (35 U.S.C. § 2(a)(1)), for as the Supreme Court has stated, "[i]nter partes review is 'a second look at an earlier administrative grant of a patent'" (*Oil States Energy Servs.*, 138 S. Ct. at 1374 (quoting *Cuozzo Speed Techs., LLC v. Lee*, 136 S. Ct. 2131, 2144 (2016)). Our rules have also made clear that *inter partes* review covers expired patents. 37 C.F.R. 42.100(b) (2012); *see also, e.g.*, 83 Fed. Reg. 51341 (Oct. 11, 2018) (Changes to the Claim Construction Standard for Interpreting Claims in Trial Proceedings Before the Patent Trial and Appeal Board)[14] ("The claim construction standard adopted in this final rule also is consistent with the same standard that the Office has applied in interpreting claims of expired patents and soon-to-be expired patents. *See, e.g.*, *Wasica Fin. GmbH v. Cont'l Auto. Sys., Inc.*, 853 F.3d 1272, 1279 (Fed. Cir. 2017) (noting that '[t]he Board construes claims of an expired patent in accordance with *Phillips* . . . [and] [u]nder that standard, words of a claim are generally given their ordinary and customary meaning').").

Further, the statutes governing *inter partes* review do not limit them to non-expired patents. For example, 35 U.S.C. § 311(b), which sets forth the scope of *inter partes* review merely refers to patents, with no mention of the expiration date. Further, 35 U.S.C. § 311(c) entitled "Filing Deadline" makes no mention of the expiration date of the patent. Elsewhere, 35 U.S.C. § 315 does limit the filing of IPRs based on civil actions and the serving of complaints, but again makes no mention of the expiration date of the patent.

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[14] *Available at* https://www.federalregister.gov/d/2018-22006/p-13.

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Patent Owner does not identify any statute or legal precedent that expressly limits *inter partes* review to non-expired patents.

Patent Owner fails to adequately explain why the Patent Office's authority to take a second look at an earlier administrative grant of a patent ends when the patent term expires even though the rights granted by the patent are not yet exhausted.

For all of these reasons, we do not agree that the Board lacks jurisdiction over expired patents.

III.   CONCLUSION

For the reasons discussed above, we determine that Petitioner has proven, by a preponderance of the evidence, that some of the challenged claims are unpatentable, as summarized in the following table:

Claims	35 U.S.C. §	Reference(s) /Basis	Claims Shown Unpatentable	Claims Not Shown Unpatentable
1, 2, 4–14, 17, 19, 21, 22, 24–28, 30	103(a)	Numazaki, Knowledge of a PHOSITA	1, 2, 4–6, 8–14, 19, 21, 22, 24–26, 28, 30	7, 17, 27
3, 15, 23	103(a)	Numazaki, Numazaki '863	3, 15, 23	
16, 29	103(a)	Numazaki, DeLuca	16, 29	
18	103(a)	Numazaki, DeLeeuw	18	
20	103(a)	Numazaki, Maruno	20	
Overall Outcome			1–6, 8–16, 18–26, 28–30	7, 17, 27

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IV.   ORDER

In consideration of the foregoing, it is hereby:

ORDERED that, claims 1–6, 8–16, 18–26, and 28–30 of U.S. Patent 8,553,079 B2 have been shown to be unpatentable;

FURTHER ORDERED that, claims 7, 17, and 27 of U.S. Patent 8,553,079 B2 have not been shown to be unpatentable; and

FURTHERED ORDERED that, because this is a Final Written Decision, parties to the proceeding seeking judicial review of the Decision must comply with the notice and service requirements of 37 C.F.R. § 90.2.

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US008553079B2

(12) United States Patent
Pryor

(10) **Patent No.:** **US 8,553,079 B2**
(45) **Date of Patent:** **Oct. 8, 2013**

(54) **MORE USEFUL MAN MACHINE INTERFACES AND APPLICATIONS**

(71) Applicant: **Timothy R. Pryor**, Sylvania, OH (US)

(72) Inventor: **Timothy R. Pryor**, Sylvania, OH (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **13/714,748**

(22) Filed: **Dec. 14, 2012**

(65) **Prior Publication Data**

US 2013/0169535 A1   Jul. 4, 2013

Related U.S. Application Data

(63) Continuation of application No. 12/700,055, filed on Feb. 4, 2010, which is a continuation of application No. 10/866,191, filed on Jun. 14, 2004, now abandoned, which is a continuation of application No. 09/433,297, filed on Nov. 3, 1999, now Pat. No. 6,750,848.

(60) Provisional application No. 60/107,652, filed on Nov. 9, 1998.

(51) **Int. Cl.**
H04N 9/47   (2006.01)
H04N 7/18   (2006.01)

(52) **U.S. Cl.**
USPC **348/77**; 348/155

(58) **Field of Classification Search**
None
See application file for complete search history.

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(57)   **ABSTRACT**

A method for determining a gesture illuminated by a light source utilizes the light source to provide illumination through a work volume above the light source. A camera is positioned to observe and determine the gesture performed in the work volume.

30 Claims, 7 Drawing Sheets

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Apple EX1001 Page 1
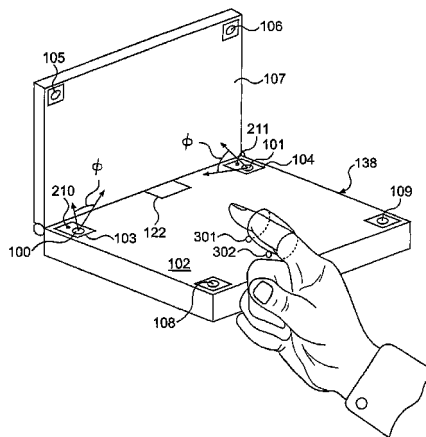
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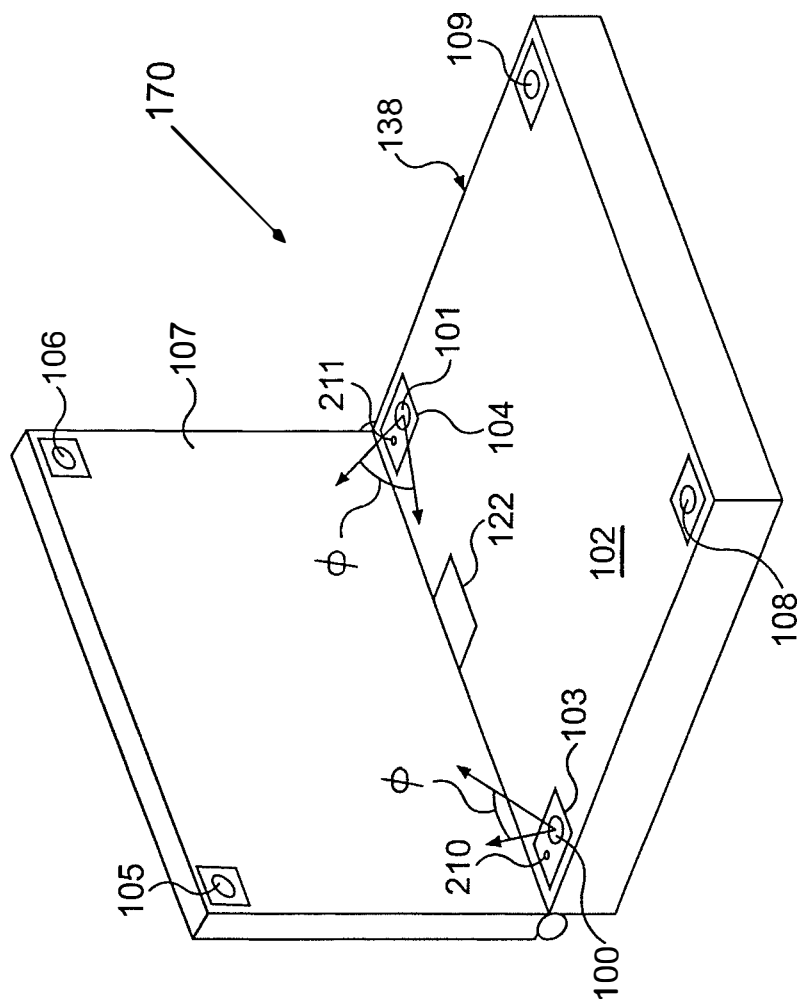
FIG. 1
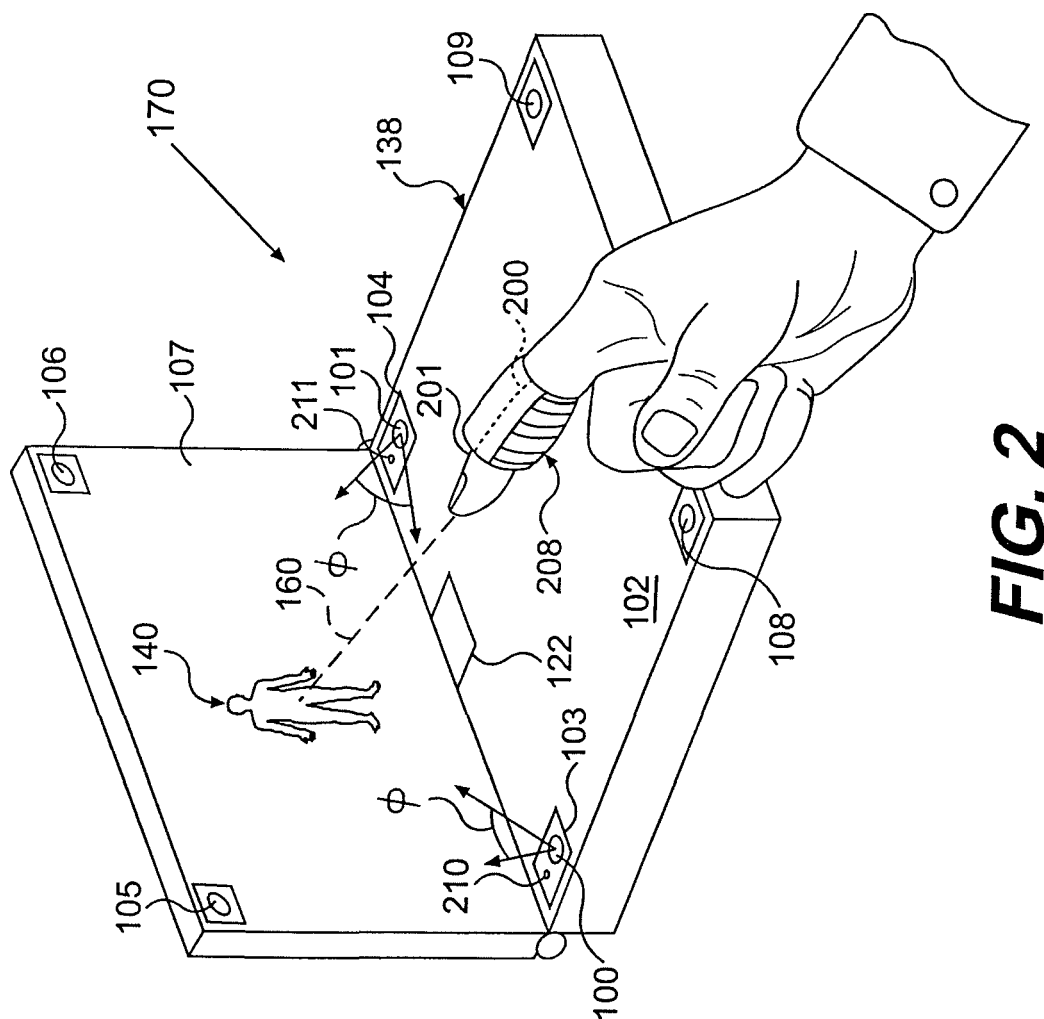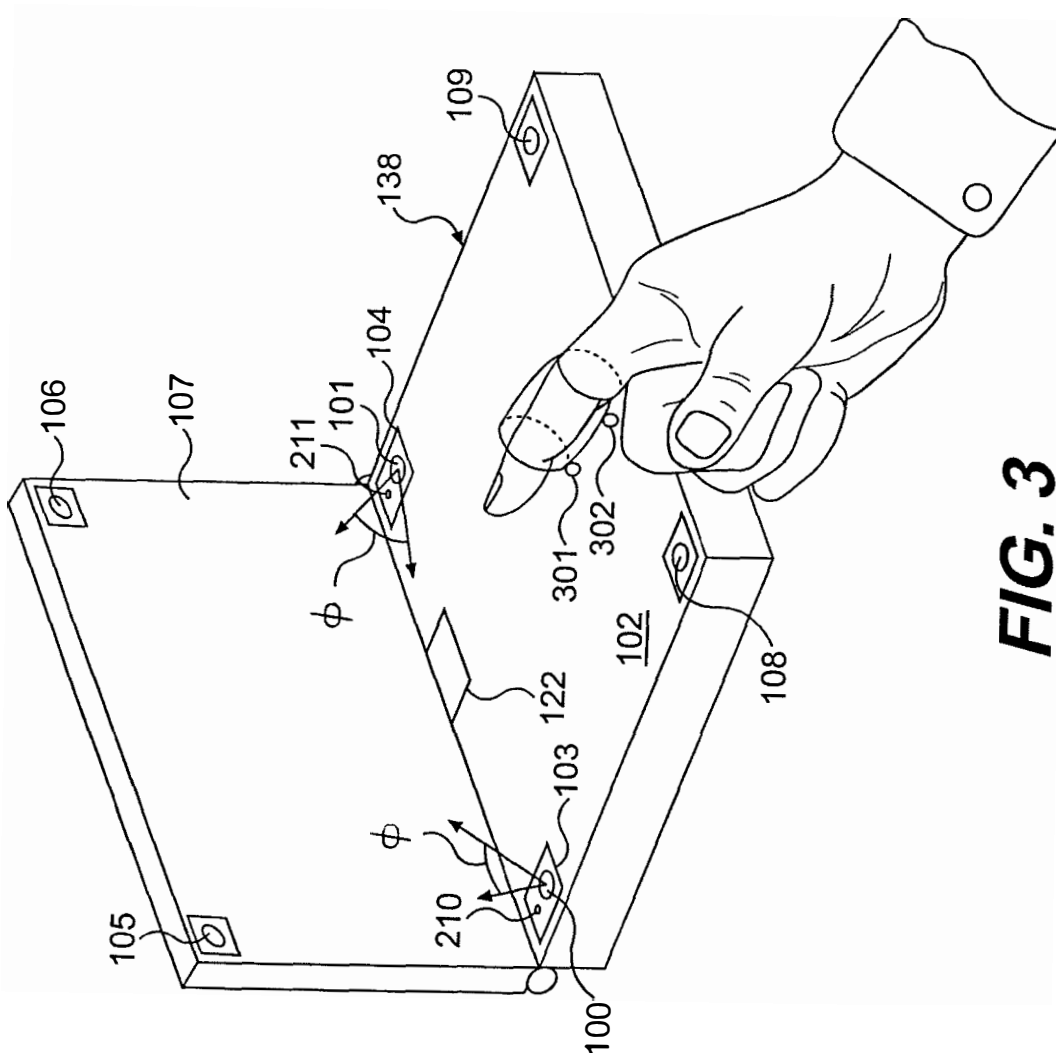
FIG. 2

FIG. 3

FIG. 4

FIG. 5

FIG. 6
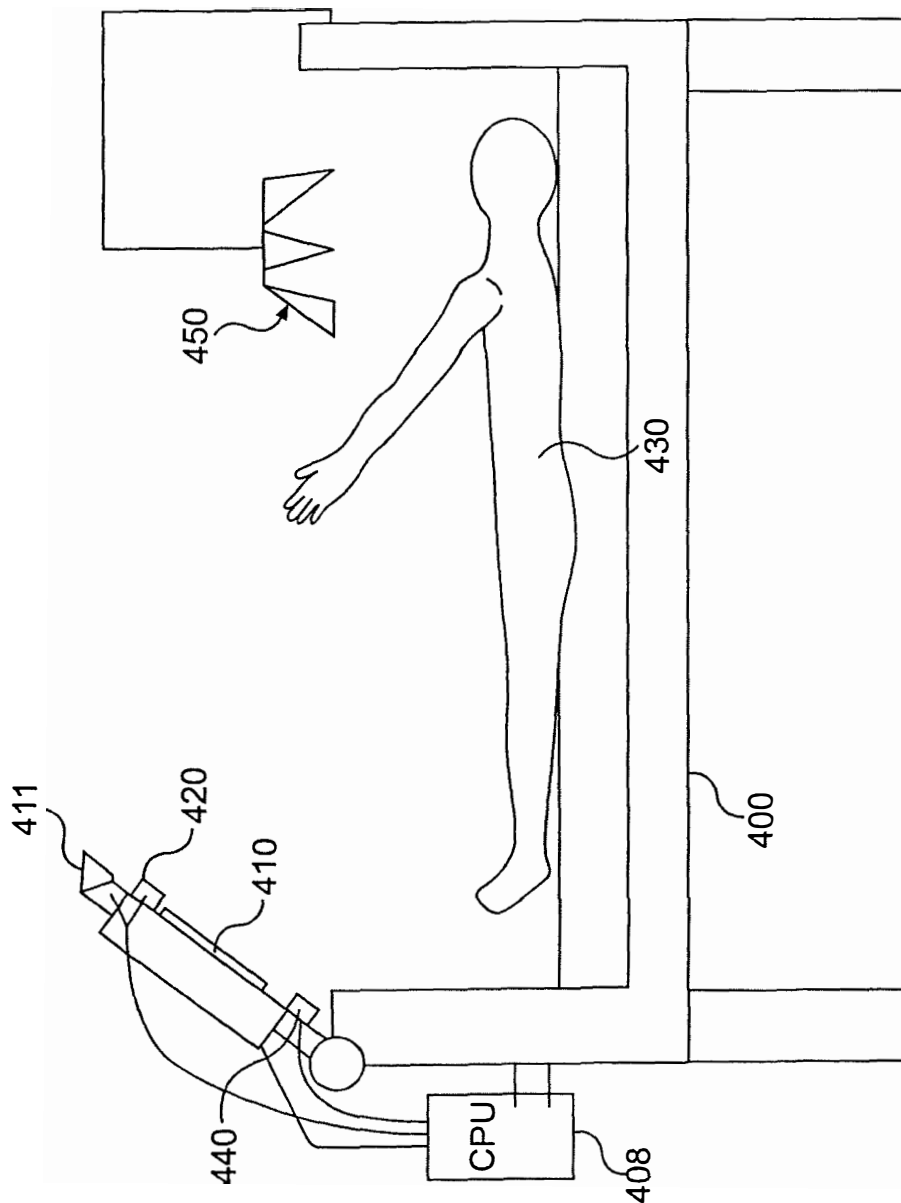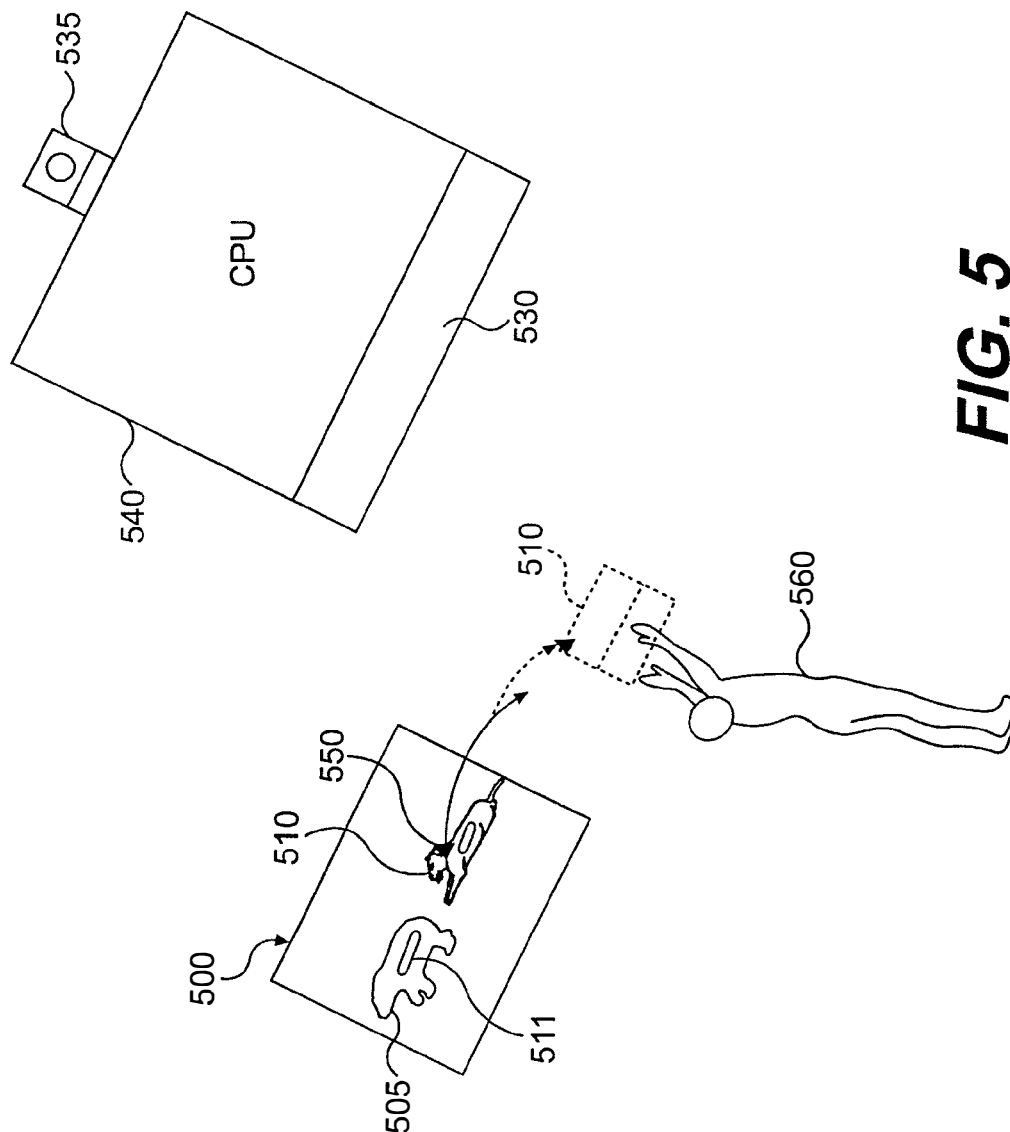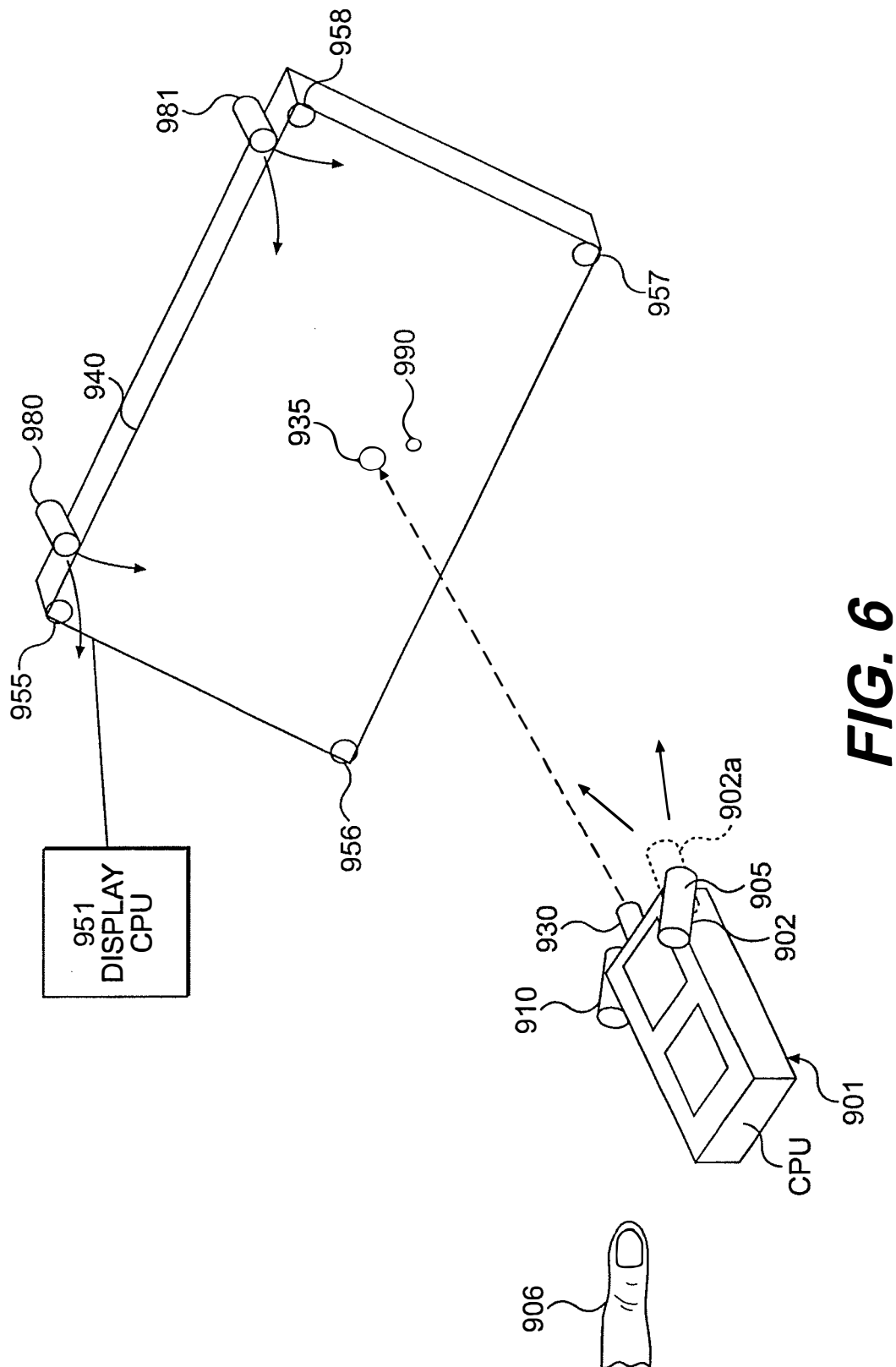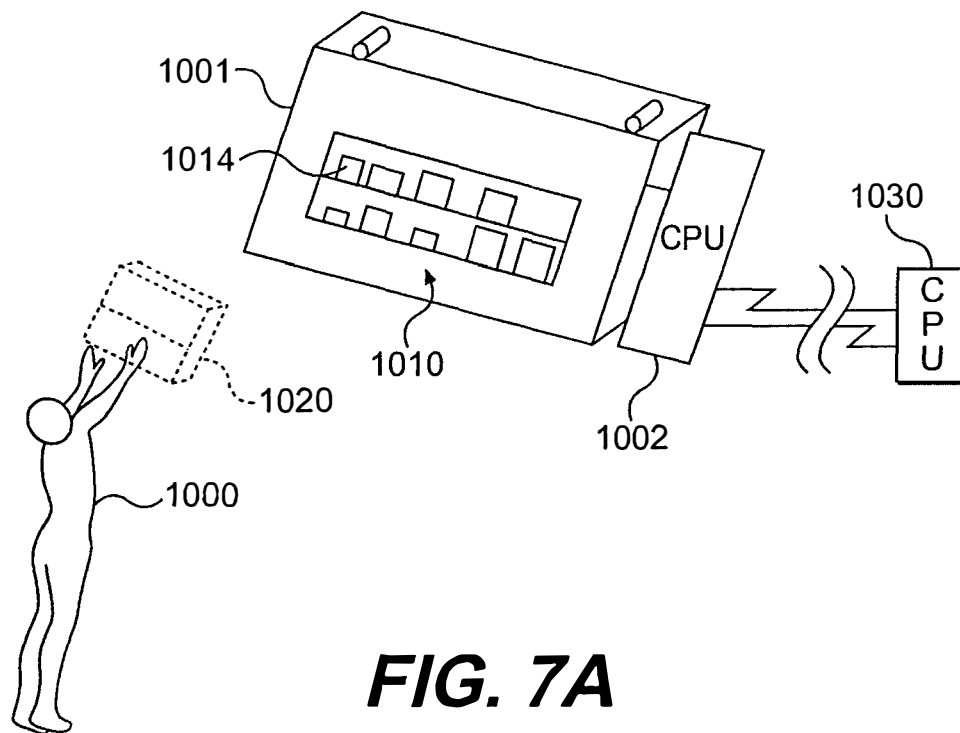
FIG. 7A
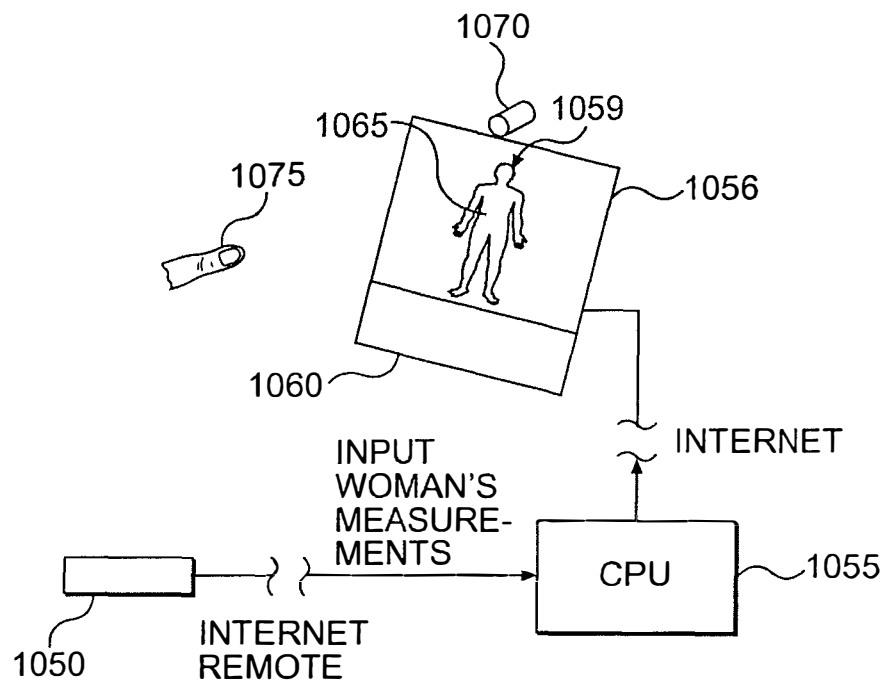
FIG. 7B

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MORE USEFUL MAN MACHINE INTERFACES AND APPLICATIONS

CROSS REFERENCE TO RELATED APPLICATIONS

This application is a continuation of U.S. patent application Ser. No. 12/700,055, filed Feb. 4, 2010, which is a continuation of U.S. patent application Ser. No. 10/866,191, filed Jun. 14, 2004, which is a continuation of U.S. patent application Ser. No. 09/433,297, filed Nov. 3, 1999 (now U.S. Pat. No. 6,750,848), which claims benefit of U.S. Provisional Application No. 60/107,652, filed Nov. 9, 1998. These applications are hereby incorporated by reference.

REFERENCES TO RELATED APPLICATIONS BY THE INVENTORS

U.S. patent application Ser. No. 09/138,339, filed Aug. 21, 1998.

U.S. Provisional Application No. 60/056,639, filed Aug. 22, 1997.

U.S. Provisional Application No. 60/059,561, filed Sep. 19, 1998.

Man Machine Interfaces: Ser. No. 08/290,516, filed Aug. 15, 1994, and now U.S. Pat. No. 6,008,800.

Touch TV and Other Man Machine Interfaces: Ser. No. 08/496,908, filed Jun. 29, 1995, and now U.S. Pat. No. 5,982, 352.

Systems for Occupant Position Sensing: Ser. No. 08/968, 114, filed Nov. 12, 1997, now abandoned, which claims benefit of Ser. No. 60/031,256, filed Nov. 12, 1996.

Target holes and corners: U.S. Ser. No. 08/203,603, filed Feb. 28, 1994, and Ser. No. 08/468,358 filed Jun. 6, 1995, now U.S. Pat. No. 5,956,417 and U.S. Pat. No. 6,044,183.

Vision Target Based Assembly: U.S. Ser. No. 08/469,429, filed Jun. 6, 1995, now abandoned; Ser. No. 08/469,907, filed Jun. 6, 1995, now U.S. Pat. No. 6,301,763; Ser. No. 08/470, 325, filed Jun. 6, 1995, now abandoned; and Ser. No. 08/466, 294, filed Jun. 6, 1995, now abandoned.

Picture Taking Method and Apparatus: Provisional Application No. 60/133,671, filed May 11, 1998.

Methods and Apparatus for Man Machine Interfaces and Related Activity: Provisional Application No. 60/133,673 filed May 11, 1998.

Camera Based Man-Machine Interfaces: Provisional Patent Application No. 60/142,777, filed Jul. 8, 1999.

The copies of the disclosure of the above referenced applications are incorporated herein by reference.

BACKGROUND OF THE INVENTION

1. Field of the Invention

The invention relates to simple input devices for computers, particularly, but not necessarily, intended for use with 3-D graphically intensive activities, and operating by optically sensing object or human positions and/or orientations. The invention in many preferred embodiments, uses real time stereo photogrammetry using single or multiple TV cameras whose output is analyzed and used as input to a personal computer, typically to gather data concerning the 3D location of parts of, or objects held by, a person or persons.

This continuation application seeks to provide further detail on useful embodiments for computing. One embodiment is a keyboard for a laptop computer (or stand alone keyboard for any computer) that incorporates digital TV cameras to look at points on, typically, the hand or the finger, or

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objects held in the hand of the user, which are used to input data to the computer. It may also or alternatively, look at the head of the user as well.

Both hands or multiple fingers of each hand, or an object in one hand and fingers of the other can be simultaneously observed, as can alternate arrangements as desired.

2. Description of Related Art

My referenced co-pending applications incorporated herein by reference discuss many prior art references in various pertinent fields, which form a background for this invention.

BRIEF DESCRIPTION OF FIGURES

FIG. **1** illustrates a laptop or other computer keyboard with cameras according to the invention located on the keyboard surface to observe objects such as fingers and hands overhead of the keyboard.

FIG. **2** illustrates another keyboard embodiment using special datums or light sources such as LEDs.

FIG. **3** illustrates a further finger detection system for laptop or other computer input.

FIG. **4** illustrates learning, amusement, monitoring, and diagnostic methods and devices for the crib, playpen and the like.

FIG. **5** illustrates a puzzle toy for young children having cut out wood characters according to the invention.

FIG. **6** illustrates an improved handheld computer embodiment of the invention, in which the camera or cameras may be used to look at objects, screens and the like as well as look at the user along the lines of FIG. **1**.

FIGS. **7**A-B illustrate new methods for internet commerce and other activities involving remote operation with 3D virtual objects display.

DESCRIPTION OF THE INVENTION

FIG. **1**

A laptop (or other) computer keyboard based embodiment is shown in FIG. **1**. In this case, a stereo pair of cameras **100** and **101** located on each side of the keyboard are used, desirably having cover windows **103** and **104** mounted flush with the keyboard surface **102**. The cameras are preferably pointed obliquely inward at angles Φ toward the center of the desired work volume **170** above the keyboard. In the case of cameras mounted at the rear of the keyboard (toward the display screen), these cameras are also inclined to point toward the user at an angle as well.

Alternate camera locations may be used such as the positions of cameras **105** and **106**, on upper corners of screen housing **107** looking down at the top of the fingers (or hands, or objects in hand or in front of the cameras), or of cameras **108** and **109** shown.

One of the referenced embodiments of the invention is to determine the pointing direction vector **160** of the user's finger (for example pointing at an object displayed on screen **107**), or the position and orientation of an object held by the user. Alternatively, finger position data can be used to determine gestures such as pinch or grip, and other examples of relative juxtaposition of objects with respect to each other, as has been described in co-pending referenced applications. Positioning of an object or portions (such as hands or fingers of a doll) is also of use, though more for use with larger keyboards and displays.

In one embodiment, shown in FIG. **2**, cameras such as **100/101** are used to simply look at the tip of a finger **201** (or thumb) of the user, or an object such as a ring **208** on the

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finger. Light from below, such as provided by single central light **122** can be used to illuminate the finger that typically looks bright under such illumination.

It is also noted that the illumination is directed or concentrated in an area where the finger is typically located such as in work volume **170**. If the light is of sufficient spectral content, the natural flesh tone of the finger can be observed—and recognized by use of the color TV cameras **100/101**.

As is typically the case, the region of the overlapping cameras viewing area is relatively isolated to the overlapping volumetric zone of their fields **170** shown due to focal lengths of their lenses and the angulation of the camera axes with respect to each other. This restricted overlap zone helps mitigate against unwanted matches in the two images due to information generated outside the zone of overlap. Thus there are no significant image matches found of other objects in the room, since the only flesh-toned object in the zone is typically the finger or fingers of the user. Or alternatively, for example, the user's hand or hands. Similarly objects or targets thereon can be distinguished by special colors or shapes.

If desired, or required, motion of the fingers can be also used to further distinguish their presence vis-a-vis any static background. If for example, by subtraction of successive camera frames, the image of a particular object is determined to have moved it is determined that this is likely the object of potential interest which can be further analyzed directly to determine if is the object of interest.

In case of obscuration of the fingers or objects in the hand, cameras in additional locations such as those mentioned above, can be used to solve for position if the view of one or more cameras is obscured.

The use of cameras mounted on both the screen and the keyboard allows one to deal with obscurations that may occur and certain objects may or may not be advantageously delineated in one view or the other.

In addition, it may be in many cases desirable to have a datum on the top of the finger as opposed to the bottom because on the bottom, it can get in the way of certain activities. In this case the sensors are required on the screen looking downward or in some other location such as off the computer entirely and located overhead has been noted in previous application.

To determine finger location, a front end processor like that described in the target holes and corners co-pending application reference incorporated U.S. Ser. Nos. 08/203,603 and 08/468,358 can be used to also allow the finger shape as well as color to be detected.

Finger gestures comprising a sequence of finger movements can also be detected by analyzing sequential image sets such as the motion of the finger, or one finger with respect to another such as in pinching something can be determined. Cameras **100** and **101** have been shown at the rear of the keyboard near the screen or at the front. They may mount in the middle of the keyboard or any other advantageous location.

The cameras can also see one's fingers directly, to allow typing as now, but without the physical keys. One can type in space above the plane of the keyboard (or in this case plane of the cameras). This is useful for those applications where the keyboard of conventional style is too big (e.g., the hand held computer of FIG. **6**).

FIG. **2**

It is also desirable for fast reliable operation to use retroreflective materials and other materials to augment the contrast of objects used in the application. For example, a line target such as **200** can be worn on a finger **201**, and advantageously can be located if desired between two joints of the

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finger as shown. This allows the tip of the finger to be used to type on the keyboard without feeling unusual—the case perhaps with target material on top of the finger.

The line image detected by the camera can be provided also by a cylinder such as retroreflective cylinder **208** worn on the finger **201** which effectively becomes a line image in the field of view of each camera (assuming each camera is equipped with a sufficiently coaxial light source, typically one or more LEDs such as **210** and **211**), can be used to solve easily using the line image pairs with the stereo cameras for the pointing direction of the finger that is often a desired result. The line, in the stereo pair of images provides the pointing direction of the finger, for example pointing at an object displayed on the screen **140** of the laptop computer **138**.

FIG. **3**

It is also possible to have light sources on the finger that can be utilized such as the 2 LED light sources shown in FIG. **3**. This can be used with either TV camera type sensors or with PSD type analog image position sensors as disclosed in references incorporated.

In particular the ring mounted LED light sources **301** and **302** can be modulated at different frequencies that can be individually discerned by sensors imaging the sources on to a respective PSD detector. Alternatively, the sources can simply be turned on and off at different times such that the position of each point can be independently found allowing the pointing direction to be calculated from the LED point data gathered by the stereo pair of PSD based sensors.

The "natural interface keyboard" here described can have cameras or other sensors located at the rear looking obliquely outward toward the front as well as inward so as to have their working volume overlap in the middle of the keyboard such as the nearly full volume over the keyboard area is accommodated.

Clearly larger keyboards can have a larger working volume than one might have on a laptop. The pair of sensors used can be augmented with other sensors mounted on the screen housing. It is noted that the linked dimension afforded for calibration between the sensors located on the screen and those on the keyboard is provided by the laptop unitary construction.

One can use angle sensing means such as a rotary encoder for the laptop screen tilt. Alternatively, cameras located on the screen can be used to image reference points on the keyboard as reference points to achieve this. This allows the calibration of the sensors mounted fixedly with respect to the screen with respect to the sensors and keyboard space below. It also allows one to use stereo pairs of sensors that are not in the horizontal direction (such as **101/102**) but could for example be a camera sensor such as **100** on the keyboard coupled with one on the screen, such as **106**.

Knowing the pointing angles of the two cameras with respect to one another allows one to solve for the 3D location of objects from the matching of the object image positions in the respective camera fields.

As noted previously, it is also of interest to locate a line or cylinder type target on the finger between the first and second joints. This allows one to use the fingertip for the keyboard activity but by raising the finger up, it can be used as a line target capable of solving for the pointed direction for example.

Alternatively one can use two point targets on the finger such as either retroreflective datums, colored datums such as rings or LED light sources that can also be used with PSD detectors which has also been noted in FIG. **2**.

When using the cameras located for the purpose of stereo determination of the position of the fingers from their flesh tone images it is useful to follow the preprocessing capable of

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processing data obtained from the cameras in order to look for the finger. This can be done on both color basis and on the basis of shape as well as motion.

In this invention, I have shown the use of not only cameras located on a screen looking downward or outward from the screen, but also cameras that can be used instead of or in combination with those on the screen placed essentially on the member on which the keyboard is incorporated. This allows essentially the keyboard to mounted cameras which are preferably mounted flush with the keyboard surface to be unobtrusive, and yet visually be able to see the users fingers, hands or objects held by the user and in some cases, the face of the user.

This arrangement is also useful for 3D displays, for example where special synchronized glasses (e.g., the "Crystal Eyes" brand often used with Silicon Graphics work stations) are used to alternatively present right and left images to each eye. In this case the object may appear to be actually in the workspace **170** above the keyboard, and it may be manipulated by virtually grasping (pushing, pulling, etc.) it, as has been described in co-pending applications.

FIG. **4**: Baby Learning and Monitoring System

A baby's reaction to the mother (or father) and the mother's analysis of the baby's reaction is very important. There are many gestures of babies apparently indicated in child psychology as being quite indicative of various needs, wants, or feelings and emotions, etc. These gestures are typically made with the baby's hands.

Today this is done and learned entirely by the mother being with the baby. However with an Electro-optical sensor based computer system, such as that described in co-pending applications located proximate to or even in the crib (for example), one can have the child's reactions recorded, not just in the sense of a video tape which would be too long and involved for most to use, but also in terms of the actual motions which could be computer recorded and analyzed also with the help of the mother as to what the baby's responses were. And such motions, combined with other audio and visual data can be very important to the baby's health, safety, and learning.

Consider for example crib **400** with computer **408** having LCD monitor **410** and speaker **411** and camera system (single or stereo) **420** as shown, able to amuse or inform baby **430**, while at the same time recording (both visually, aurally, and in movement detected position data concerning parts of his body or objects such as rattles in his hand) his responses for any or all of the purposes of diagnosis of his state of being, remote transmission of his state, cues to various programs or images to display to him or broadcast to others, or the like.

For one example, baby's motions could be used to signal a response from the TV either in the absence of the mother or with the mother watching on a remote channel. This can even be over the Internet if the mother is at work.

For example, a comforting message could come up on the TV from the mother that could be prerecorded (or alternatively could actually be live with TV cameras in the mother's or father's workplace for example on a computer used by the parent) to tell the baby something reassuring or comfort the baby or whatever. Indeed the parent can be monitored using the invention and indicate something back or even control a teleoperater robotic device to give a small child something to eat or drink for example. The same applies to a disabled person.

If the father or mother came up on the screen, the baby could wave at it, move its head or "talk" to it but the hand gestures may be the most important.

If the mother knows what the baby is after, she can talk to baby or say something, or show something that the baby

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recognizes such as a doll. After a while, looking at this live one can then move to talking to the baby from some prerecorded data.

What other things might we suppose? The baby for example knows to puts its hand on the mother's cheek to cause the mother to turn to it. The baby also learns some other reflexes when it is very young that it forgets when it gets older. Many of these reflexes are hand movements, and are important in communicating with the remote TV based mother representation, whether real via telepresense or from CD Rom or DVD disk (or other media, including information transmitted to the computer from afar) and for the learning of the baby's actions.

Certainly just from the making the baby feel good point-of-view, it would seem like certain motherly (or fatherly, etc.) responses to certain baby actions in the form of words and images would be useful. This stops short of physical holding of the baby which is often needed, but could act as a stop gap to allow the parents to get another hour's sleep for example.

As far as the baby touching things, I've discussed in other applications methods for realistic touch combined with images. This leads to a new form of touching crib mobiles that could contain video imaged and or be imaged themselves—plus if desired—touched in ways that would be far beyond any response that you could get from a normal mobile.

For example, let us say there is a targeted (or otherwise TV observable) mobile **450** in the crib above the baby. Baby reaches up and touches a piece of the mobile which is sensed by the TV camera system (either from the baby's hand position, the mobile movement, or both, and a certain sound is called up by the computer, a musical note for example. Another piece of the mobile and another musical note. The mobile becomes a musical instrument for the baby that could play either notes or chords or complete passages, or any other desired programmed function.

The baby can also signal things. The baby can signal using agitated movements would often mean that it's unhappy. This could be interpreted using learned movement signatures and artificial intelligence as needed by the computer to call for mother even if the baby wasn't crying. If the baby cries, that can be picked up by microphone **440**, recognized using a voice recognition system along the lines of that used in IBM Via Voice commercial product for example. And even the degree of crying can be analyzed to determine appropriate action.

The computer could also be used to transmit information of this sort via the internet email to the mother who could even be at work. And until help arrives in the form of mother intervention or whatever, the computer could access a program that could display on a screen for the baby things that the baby likes and could try to soothe the baby through either images of familiar things, music or whatever. This could be useful at night when parents need sleep, and anything that would make the baby feel more comfortable would help the parents.

It could also be used to allow the baby to input to the device. For example, if the baby was hungry, a picture of the bottle could be brought up on the screen. The baby then could yell for the bottle. Or if the baby needed his diaper changed, perhaps something reminiscent of that. If the baby reacts to such suggestions of his problem, this gives a lot more intelligence as to why he is crying and while mothers can generally tell right away, not everyone else can. In other words, this is pretty neat for babysitters and other members of the household so they can act more intelligently on the signals the baby is providing.

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Besides in the crib, the system as described can be used in conjunction with a playpen, hi-chair or other place of baby activity.

As the child gets older, the invention can further be used also with more advanced activity with toys, and to take data from toy positions as well. For example, blocks, dolls, little cars, and moving toys even such as trikes, scooters, drivable toy cars and bikes with training wheels.

The following figure illustrates the ability of the invention to learn, and thus to assist in the creation of toys and other things.

FIG. **5**: Learning Puzzle Roy

Disclosed in FIG. **5** is a puzzle toy **500** where woodcut animals such as bear **505** and lion **510** are pulled out with handle such as **511**. The child can show the animal to the camera and a computer **530** with TV camera (or cameras) **535** can recognize the shape as the animal, and provide a suitable image and sounds on screen **540**.

Alternatively, and more simply, a target, or targets on the back of the animal can be used such as triangle **550** on the back of lion **511**. In either case the camera can solve for the 3D, and even 5 or 6D position and orientation of the animal object, and cause it to move accordingly on the screen as the child maneuvers it. The child can hold two animals, one in each hand and they can each be detected, even with a single camera, and be programmed in software to interact as the child wishes (or as he learns the program).

This is clearly for very young children of two or three years of age. The toys have to be large so they can't be swallowed.

With the invention in this manner, one can make a toy of virtually anything, for example a block. Just hold this block up, teach the computer/camera system the object and play using any program you might want to represent it and its actions. To make this block known to the system, the shape of the block, the color of the block or some code on the block can be determined. Any of those items could tell the camera which block it was, and most could give position and orientation if known.

At that point, an image is called up from the computer representing that particular animal or whatever else the block is supposed to represent. Of course this can be changed in the computer to be a variety of things if this is something that is acceptable to the child. It could certainly be changed in size such as a small lion could grow into a large lion. The child could probably absorb that more than a lion changing into a giraffe for example since the block wouldn't correspond to that. The child can program or teach the system any of his blocks to be the animal he wants and that might be fun.

For example, he or the child's parent could program a square to be a giraffe where as a triangle would be a lion. Maybe this could be an interesting way to get the child to learn his geometric shapes!

Now the basic block held up in front of the camera system could be looked at just for what it is. As the child may move the thing toward or away from the camera system, one may get a rough sense of depth from the change in shape of the object. However this is not so easy as the object changes in shape due to any sort of rotations.

Particularly interesting then is to also sense the rotations if the object so that the animal can actually move realistically in 3 Dimensions on the screen. And perhaps having the de-tuning of the shape of the movement so that the child's relatively jerky movements would not appear jerky on the screen or would not look so accentuated. Conversely of course, you can go the other way and accentuate the motions.

This can, for example, be done with a line target around the edge of the object is often useful for providing position or orientation information to the TV camera based analysis software, and in making the object easier to see in reflective illumination.

Aid to Speech Recognition

The previous co-pending application entitled "Useful man machine interfaces and applications" referenced above, discussed the use of persons movements or positions to aid in recognizing the voice spoken by the person.

In one instance, this can be achieved by simply using ones hand to indicate to the camera system of the computer that the voice recognition should start (or stop, or any other function, such as a paragraph or sentence end, etc.).

Another example is to use the camera system of the invention to determine the location of the persons head (or other part), from which one can instruct a computer to preferentially evaluate the sound field in phase and amplitude of two or more spaced microphones to listen from that location—thus aiding the pickup of speech—which often times is not able to be heard well enough for computer based automatic speech recognition to occur.

Digital Interactive TV

As you watch TV, data can be taken from the camera system of the invention and transmitted back to the source of programming. This could include voting on a given proposition by raising your hand for example, with your hand indication transmitted. Or you could hold up 3 fingers, and the count of fingers transmitted. Or in a more extreme case, your position, or the position of an object or portion thereof could be transmitted—for example you could buy a coded object—whose code would be transmitted to indicate that you personally (having been pre-registered) had transmitted a certain packet of data.

If the programming source can transmit individually to you (not possible today, but forecast for the future), then much more is possible. The actual image and voice can respond using the invention to positions and orientations of persons or objects in the room—just as in the case of prerecorded data—or one to one internet connections. This allows group activity as well.

In the extreme case, full video is transmitted in both directions and total interaction of users and programming sources and each other becomes possible.

An interim possibility using the invention is to have a program broadcast to many, which shifts to prerecorded DVD disc or the like driving a local image, say when your hand input causes a signal to be activated.

Handwriting Authentication

A referenced co-pending application illustrated the use of the invention to track the position of a pencil in three dimensional space such that the point at which the user intends the writing point to be at, can be identified and therefore used to input information, such as the intended script.

As herein disclosed, this part of the invention can also be used for the purpose of determining whether or not a given person's handwriting or signature is correct.

For example, consider authentication of an Internet commercial transaction. In this case, the user simply writes his name or address and the invention is used to look at the movements of his writing instrument and determine from that whether or not the signature is authentic. (A movement of one or more of his body parts might also or alternatively be employed). For example a series of frames of datum location on his pen can be taken, to determine one or more positions on it as a function of time, even to include calculating of its pointing direction, from a determined knowledge in three axes of two points along the line of the pen axis. In this case

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a particular pointing vector sequence "signature" would be learned for this person, and compared to later signatures.

What is anticipated here is that in order to add what you might call the confirming degree of authenticity to the signature, it may not be necessary to track the signature completely. Rather one might only determine that certain aspects of the movement of the pencil are the authentic ones. One could have people write using any kind of movement, not just their signature having their name. The fact is that people are mostly used to writing their name and it would be assumed that that would be it. However, it could well be that the computer asks the user to write something else that they would then write and that particular thing would be stored in the memory.

Optionally, one's voice could be recognized in conjunction with the motion signature to add further confirmation.

This type of ability for the computer system at the other end of the Internet to query a writer to write a specific thing in a random fashion adds a degree of cryptographic capacity to the invention. In other words, if I can store the movements in my hand to write different things, then clearly this has some value.

The important thing though is that some sort of representation of the movements of the pencil or other instrument can be detected using the invention and transmitted.

FIG. **6**: Hand Held Computer

FIG. **6** illustrates an improved handheld computer embodiment of the invention. For example, FIG. **8** of the provisional application referenced above entitled "camera based man machine interfaces and applications" illustrates a basic hand held device and which is a phone, or a computer or a combination thereof, or alternatively to being hand held, can be a wearable computer for example on one's wrist.

In this embodiment, we further disclose the use of this device as a computer, with a major improvement being the incorporation of a camera of the device optionally in a position to look at the user, or an object held by the user—along the lines of FIG. **1** of the instant disclosure for example.

Consider hand held computer **901** of FIG. **6**, incorporating a camera **902** which can optionally be rotated about axis **905** so as to look at the user or a portion thereof such as finger **906**, or at objects at which it is pointed. Optionally, and often desirably, a stereo pair of cameras to further include camera **910** can also be used. It too may rotate, as desired. Alternatively fixed cameras can be used as in FIG. **1**, and FIG. **8** of the referenced co-pending application, when physical rotation is not desired, for ruggedness, ease of use, or other reasons (noting that fixed cameras have fixed fields of view, which limit versatility in some cases).

When aimed at the user, as shown, it can be used, for example, to view and obtain images of:

Ones self-facial expression etc., also for image reasons, id etc., combined effect.

Ones fingers (any or all), one finger to other and the like. This in turn allows conversing with the computer in a form of sign language which can replace the keyboard of a conventional computer.

One or more pbjects in one's hand. Includes a pencil or pen, and thus can be used rather than having a special touch screen and pencil if the pencil itself is tracked as disclosed in the above figure. It also allows small children to use the device, and those who cannot hold an ordinary stylus.

One's Gestures.

The camera **902** (and **910** if used, and if desired), can also be optionally rotated and used to viewpoints in space ahead of the device, as shown in dotted lines **902**a. In this position for example it can be used for the purposes described in previous application. It can also be used to observe or point at

(using optional laser pointer **930**) points such as **935** on a wall, or a mounted LCD or projection display such as **940** on a wall or elsewhere such as on the back of an airline seat.

With this feature of the invention, there is no requirement to carry a computer display with you as with a infrared connection (not shown) such as known in the art one can also transmit all normal control information to the display control computer **951**. As displays become ubiquitous, this makes increasing sense—otherwise the displays get bigger the computers smaller trend doesn't make sense if they need to be dragged around together. As one walks into a room, one uses the display or displays in that room (which might themselves be interconnected).

The camera unit **902** can sense the location of the display in space relative to the handheld computer, using for example the four points **955-958** on the corners of the display as references. This allows the handheld device to become an accurate pointer for objects displayed on the screen, including control icons. And it allows the objects on the screen to be sensed directly by the camera—if one does not have the capability to spatially synchronize and coordinate the display driver with the handheld computer.

The camera can also be used to see gestures of others, as well as the user, and to acquire raw video images of objects in its field.

A reverse situation also exists where the cameras can be on the wall mounted display, such as cameras **980** and **981** can be used to look at the handheld computer module **901** and determine its position and orientation relative to the display.

Note that a camera such as **902**, looking at you the user, if attached to hand held unit, always has reference frame of that unit. If one works with a screen on a wall, one can aim the handheld unit with camera at it, and determine its reference frame to the handheld unit. Also can have two cameras operating together, one looking at wall thing, other at you (as **902** and **902**a) in this manner, one can dynamically compare ref frames of the display to the human input means in determining display parameters. This can be done in real time, and if so one can actually wave the handheld unit around while still imputing accurate data to the display using ones fingers, objects or whatever.

Use of a laser pointer such as **930** incorporated into the handheld unit has also been disclosed in the referenced copending applications. For example, a camera on the hand held computer unit such as **902** viewing in direction **902**a would look at laser spot such as **990** (which might or might not have come from the computers own laser pointer **930**) on the wall display say, and recognized by color and size/shape reference to edge of screen, and to projected spots on screen.

FIGS. **7**A-B: Internet and Other Remote Applications

FIG. **7**A illustrates new methods for internet commerce and other activities involving remote operation with 3D virtual objects displayed on a screen. This application also illustrates the ability of the invention to prevent computer vision eye strain.

Let us first consider the operation of the invention over the internet as it exists today in highly bandwidth limited form dependent on ordinary phone lines for the most part. In this case it is highly desirable to transmit just the locations or pointing vectors of portions (typically determined by stereo photo-grammetry of the invention) of human users or objects associated therewith to a remote location, to allow the remote computer **10** to modify the image or sound transmitted back to the user.

Another issue is the internet time delay, which can exist in varying degrees, and is more noticeable, the higher resolution of the imagery transmitted. In this case, a preferred arrange-

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ment is to have real time transmission of minimal position and vector data (using no more bandwidth than voice), and to transmit back to the user, quasi stationary images at good resolution. Transmission of low resolution near real time images common in internet telephony today, does not convey the natural feeling desired for many commercial applications to now be discussed. As bandwidth becomes more plentiful these restrictions are eased.

Let us consider the problem posed of getting information from the internet of today. A user **1000** can go to a virtual library displayed on screen **1001** controlled by computer **1002** where one sees a group **1010** of books on stacks. Using the invention as described herein and incorporated referenced applications to determine my hand and finger locations, I the user, can point at a book such as **1014** in a computer sensed manner, or even reach out and "grab" a book, such as **1020** (dotted lines) apparently generated in 3D in front of me.

My pointing, or my reach and grab is in real time, and the vector (such as the pointing direction of ones finger at the book on the screen, or the position and orientation closing vectors of one's forefinger and thumb to grab the 3D image **1020** of the book) indicating the book in question created is transmitted back by internet means to the remote computer **1030** which determines that I have grabbed the book entitled War and Peace from the virtual shelf. A picture of the book coming off the shelf is then generated using fast 3D graphical imagery such as the Merlin VR package available today from Digital Immersion company of Sudbury, Ontario. This picture (and the original picture of the books on the shelves) can be retransmitted over the internet at low resolution (but sufficient speed) to give a feeling of immediacy to the user. Or alternatively, the imagery can be generated locally at higher resolution using the software package resident in the local computer **1002** which receives key commands from the distant computer **1030**.

After the book has been "received" by the user, it then can be opened automatically to the cover page for example under control of the computer, or the users **10** hands can pretend to open it, and the sensed hands instruct the remote (or local, depending on version) computer to do so. A surrogate book such as **1040** can also be used to give the user a tactile feel of a book, even though the real book in questions pages will be viewed on the display screen **1001**. One difference to this could be if the screen **1001** depicting the books were life size, like real stacks. Then one might wish to go over to a surrogate book incorporating a separate display screen—just as one would in a real library, go to a reading table after removing a book from a stack.

Net Grocery stores have already appeared, and similar applications concern picking groceries off of the shelf of a virtual supermarket, and filling ones shopping cart. For that matter, any store where it is desired to show the merchandise in the very manner people are accustomed to seeing it, namely on shelves or racks, generally as one walks down an aisle, or fumbles through a rack of clothes for example. In each case, the invention, which also can optionally use voice input, as if to talk to a clothing sales person, can be used to monitor the person's positions and gestures.

The invention in this mode can also be used to allow one to peruse much larger objects. For example, to buy a car (or walk through a house, say) over the internet, one can lift the hood, look inside, etc., all by using the invention to monitor the 3D position of your head or hands and move the image of the car presented accordingly. If the image is presented substantially life-size, then one can be monitored as one physically walks around the car in one's room say, with the image changing accordingly. In other words just as today.

Note that while the image can be apparently life-size using virtual reality glasses, the natural movements one is accustomed to in buying a car are not present. This invention makes such a natural situation possible (though it can also be used with such glasses as well).

It is noted that the invention also comprehends adding a force based function to a feedback to your hands, such that it feels like you lifted the hood, or grabbed the book, say. For this purpose holding a surrogate object as described in co-pending applications could be useful, in this case providing force feedback to the object.

If one looks at internet commerce today, some big applications have turned out **10** to be clothes and books. Clothes are by far the largest expenditure item, and let's look closer at this.

Consider too a virtual mannequin, which can also have measurements of a remote shopper. For example, consider diagram **78**, where a woman's measurements are inputted by known means such as a keyboard **1050** over the internet to a CAD program in computer **1055**, which creates on display screen **1056** a 3D representation of a mannequin **1059** having the woman's shape in the home computer **1060**. As she selects a dress **1065** to try on, the dress which let's say comes in 10 sizes, 5 to 15, is virtually "tried on" the virtual mannequin and the woman **1070** looks at the screen **1056** and determines the fit of a standard size 12 dress. She can rapidly select larger or smaller sizes and decide which she thinks looks and/or fits better.

Optionally, she can signal to the computer to rotate the image in any direction, and can look at it from different angles up or down as well, simply doing a rotation in the computer. This signaling can be conventional using for example a mouse, or can be using TV based sensing aspects of the invention such as employing camera **1070** also as shown in FIG. **1** for example. In another such case, she can reach out with her finger **1075** for example, and push or pull in a virtual manner the material, using the camera to sense the direction of her finger. Or she can touch herself at the points where the material should be taken up or let out, with the camera system sensing the locations of touch (typically requiring at least a stereo pair of cameras or other electro-optical system capable of determining where her fingertip is in 3D space. Note that a surrogate for the tried on dress in this case, could be the dress she has on, which is touched in the location desired on the displayed dress.

The standard size dress can then be altered and shipped to her, or the requisite modifications can be made in the CAD program, and a special dress cut out and sewed which would fit better.

A person can also use her hands via the TV cameras of the invention to determine hand location relative to the display to take clothes off a virtual manikin which could have a representation of any person real or imaginary. Alternatively she can remotely reach out using the invention to a virtual rack of clothes such as **1090**, take an object off the rack, and put it on the manikin. This is particularly natural in near life-size representation, just like being in a store or other venue. This ability of the invention to bring real life experience to computer shopping and other activity that is a major advantage.

The user can also feel the texture of the cloth if suitable haptic devices are **15** available to the user, which can be activated remotely by the virtual clothing program, or other type of program.

Modifications of the invention herein disclosed will occur to persons skilled in the art, and all such modifications are deemed to be within the scope of the invention as defined by the appended claims.

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The invention claimed is:

1. A computer implemented method comprising:

providing a light source adapted to direct illumination through a work volume above the light source;

providing a camera oriented to observe a gesture performed in the work volume, the camera being fixed relative to the light source; and

determining, using the camera, the gesture performed in the work volume and illuminated by the light source.

2. The method according to claim 1 wherein the light source includes a light emitting diode.

3. The method according to claim 1 wherein the light source includes a plurality of light emitting diodes.

4. The method according to claim 1 wherein detecting a gesture includes analyzing sequential images of the camera.

5. The method according to claim 1 wherein the detected gesture includes at least one of a pinch gesture, a pointing gesture, and a grip gesture.

6. The method according to claim 1 further including determining the pointing direction of a finger in the work volume.

7. The method according to claim 1 further including providing a target positioned on a user that is viewable in the work volume.

8. The method according to claim 1 further including determining the three-dimensional position of a point on a user.

9. The method according to claim 1 wherein the camera and the light source are positioned in fixed relation relative to a keypad.

10. The method according to claim 9 the camera, the light source and the keypad form part of a laptop computer.

11. A computer apparatus comprising:

a light source adapted to illuminate a human body part within a work volume generally above the light source;

a camera in fixed relation relative to the light source and oriented to observe a gesture performed by the human body part in the work volume; and

a processor adapted to determine the gesture performed in the work volume and illuminated by the light source based on the camera output.

12. The computer apparatus of claim 11 further including a display and a keyboard, wherein the work volume is above the keyboard and in front of the display.

13. The computer apparatus of claim 12 wherein the display is pivotable relative to the keyboard.

14. The computer apparatus of claim 11 wherein the light source includes a light emitting diode.

15. The computer apparatus of claim 11 wherein the light source includes a plurality of light emitting diodes.

16. The computer apparatus of claim 12 wherein the display includes a three-dimensional display.

17. The computer apparatus of claim 11 further including a target that is viewable by the camera when in the work volume.

18. The computer apparatus of claim 11 wherein the determined gesture includes a pinch gesture.

19. The computer apparatus of claim 11 wherein the determined gesture includes a pointing gesture.

20. The computer apparatus of claim 11 wherein the determined gesture includes a grip gesture.

21. A computer implemented method comprising:

providing a camera oriented to observe a gesture performed in a work volume above the camera;

providing a light source in fixed relation relative to the camera and adapted to direct illumination through the work volume; and

detecting, using the camera, a gesture performed by at least one of a user's fingers and a user's hand in the work volume.

22. The method according to claim 21 wherein the light source includes a light emitting diode.

23. The method according to claim 21 wherein the light source includes a plurality of light emitting diodes.

24. The method according to claim 21 wherein detecting a gesture includes analyzing sequential images of the camera.

25. The method according to claim 21 wherein the detected gesture includes at least one of a pinch gesture, a pointing gesture, and a grip gesture.

26. The method according to claim 21 further including determining the pointing direction of one of the user's fingers using the first and second cameras.

27. The method according to claim 21 further including providing a target positioned on the user that is viewable by the camera.

28. The method according to claim 21 further including determining the three-dimensional position of a point on at least one of the user's hand and the user's fingers.

29. The method according to claim 21 further including providing a three-dimensional display viewable by the user.

30. The method according to claim 21 wherein the camera and the light source are positioned in fixed relation relative to a keypad.

* * * * *